SCIENTIFIC AMERICAN

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THE VESSELS OF COLUMBUS.

The Santa Maria, the largest of the three vessels in the little fleet of Columbus on his first voyage of discovery, is shown below on this page, as it is represented by the drawings made at the time by Juan de la Cosa, who was a pilot on the vessel. A reproduction of this vessel was launched at Carraca, Spain, June 26, and her appearance at the time is shown in the accompanying view. This vessel is being built at the expense of the Spanish government, and the two smaller vessels of the fleet are at the same time under construction in that country, at the expense of our government, and under the supervision of United States officers, acting in conjunction with the Spanish committee.

The Santa Maria was built at the arsenal of Carraca, sixty-three days being taken for the construction of the vessel, under the direction of engineer Leopoldi Puente y Wilke. Her length between perpendiculars is 22·60 meters; length over all, 29·10 meters; extreme beam, 9·86 meters. The hull weighs 127 tons; it has five decks and a main mast, fore mast, mizzen mast, bowsprit. The armament consists of six falconets and two lombards, the latter being on the main deck.

It is intended that all three of these vessels shall be completed in time to take part in a celebration in Spain, commemorative of the date of the sailing of Columbus, August 3, 1492. The vessels are then to be sent to this country, arriving in New York in time to

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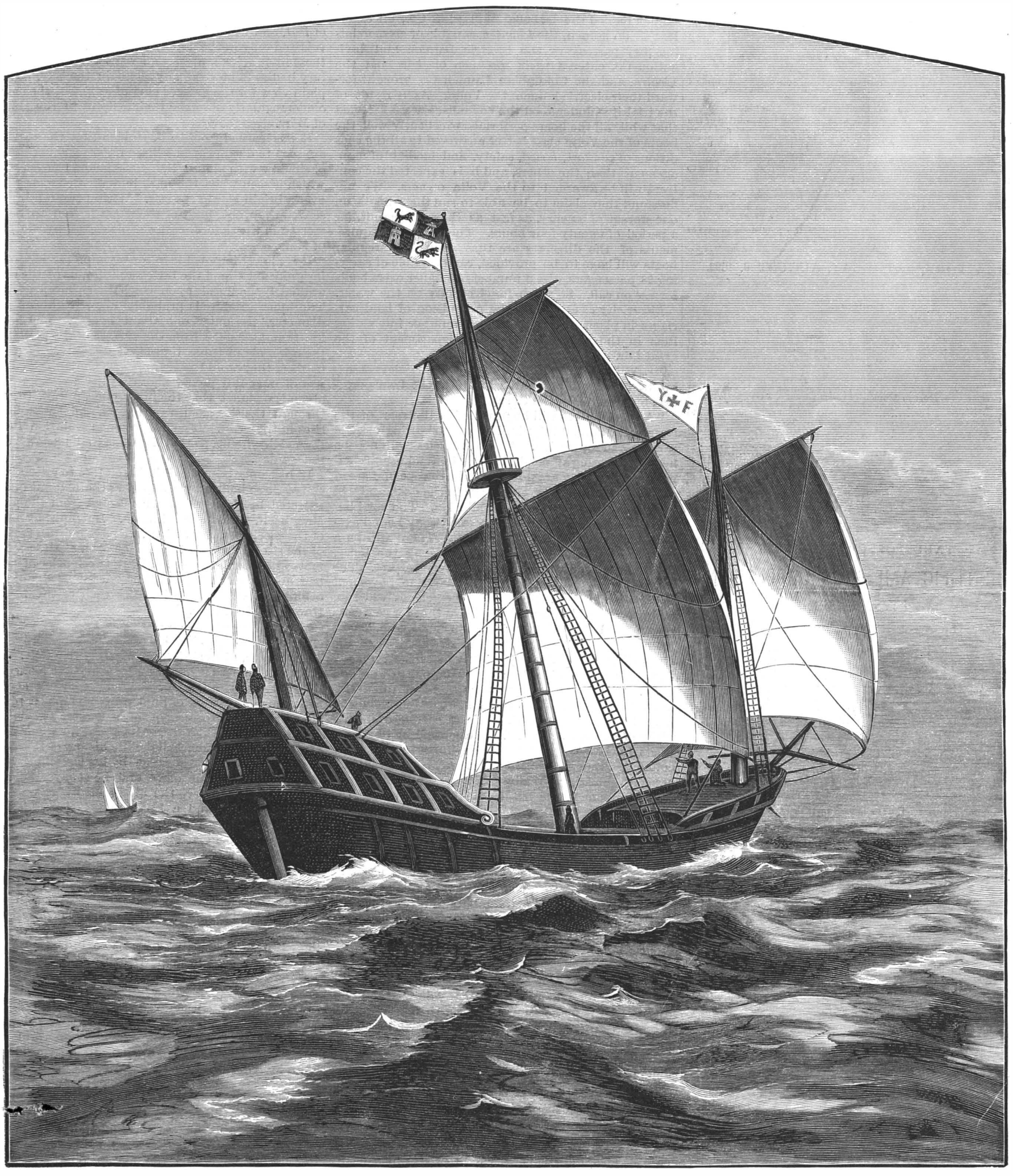

THE SANTA MARIA—A COPY OF COLUMBUS' SHIP, RECENTLY BUILT IN SPAIN.

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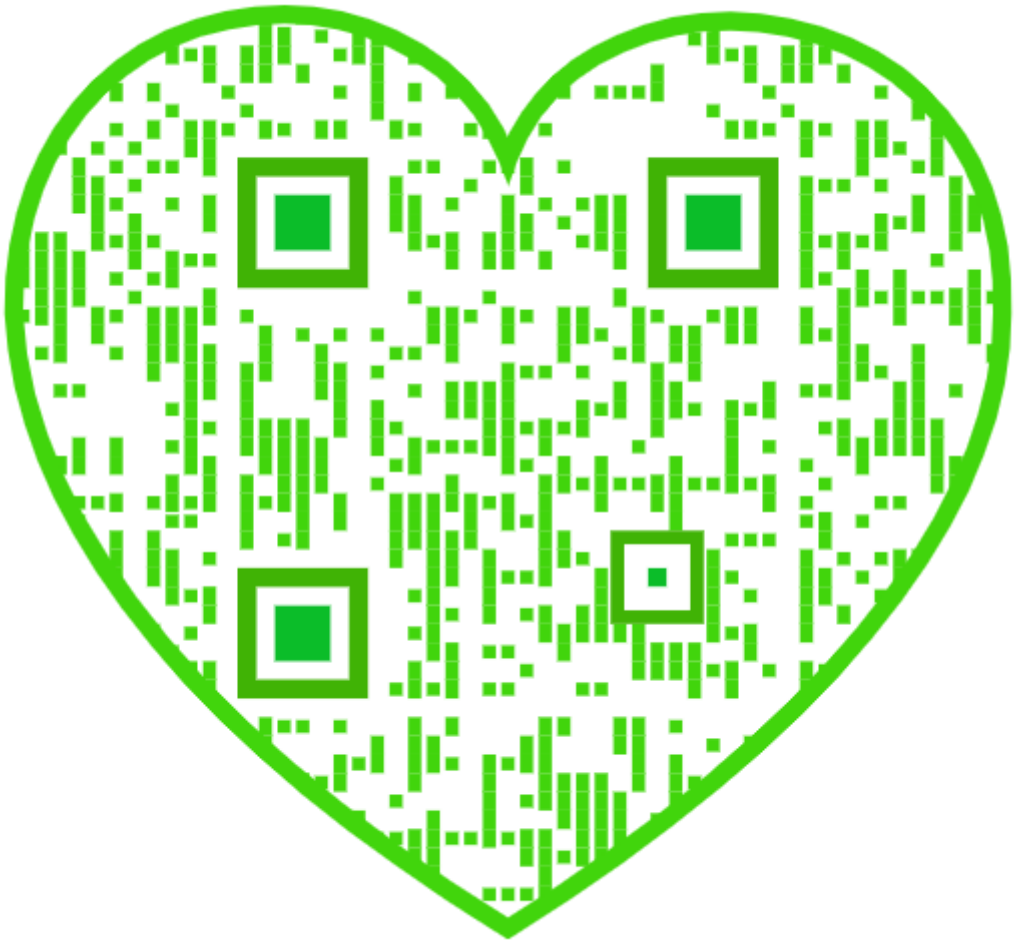

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ELECTRIC BOATS AND CARRIAGES AT THE COLUMBIAN EXPOSITION.

An attractive feature at the World's Columbian Exposition will be the navigation of the lagoons by pleasure boats. The visitor will have the double enjoyment of a sail and excellent water views of the wonderful buildings and other exterior objects of the great exposition. The committee charged with the selection of boats best suited for this particular purpose were in doubts as to which their approval should be given, and with a view of settling the matter they invited several different makers to bring forward specimens of their boats and join in a practical trial of merits on the waters of the grand basin. The preliminary trial took place on the 14th of last month.

It was understood by the competitors that the concession or right of running boats should be awarded to the parties whose vessels made the least noise and gave out the least heat and smoke. The prime object of the directors was to secure the comfort of the visitors. More than this, the expectation is that hundreds of thousands of people will patronize the boats, and the share of the proceeds coming to the exposition will be large.

At the trial above mentioned four specimen boats were on hand. Meeker & Co. presented a fine steam launch named the Isabella; Willard & Co., an excellent steam launch, the America, capable of accomodating fifty passengers; the Electric Launch and Navigation Co. entered their specimen electric boat the Electra, and the Columbian Launch Co. brought forward their electric launch the Volta. As a result of the trial it is understood the committee were satisfied that while all the boats performed excellently well, the boats of the Volta class better answered to all the conditions of comfort, speed, safety, and facility of management than the others, and it is expected the contract will be awarded to the Volta owners. We understand they claim to be able to run their boats on one storage of energy, as fast as the rules permit, for a period of twenty-four hours. The expected requirements of the directors are that about fifty regular boats will have to be provided, each capable of carrying 28 passengers, also a number of smaller extra boats for use on call. So much for electricity on the water.

Electricity as applied to the propulsion of land carriages in place of horses will form another interesting item in the wondrous electrical department of the great fair.

Mr. Willard A. Smith has charge of this class of exhibits, which will be located in the great transportation building. Mr. Smith says:

"A special place will be provided in the rear of the transportation exhibits building for showing electric carriages in operation. These vehicles will not be heavy lumbering affairs, but will be built for use on common roads. They are now in use in Europe and are a success. American inventors are in the field, and will have some fine carriages on exhibition. The road between the transportation annex and Stony Island avenue is well adapted for the exhibit. There will be a line of trees, vines and shrubbery along the fence, making the road very pleasant in every respect. The railroad tracks will be removed and a fine pavement laid. Up and down this road the carriages will run, and people will be surprised to learn that for centuries money has been uselessly tied up in horse flesh."

The removal of horses from the street cars and the propulsion of the latter by means of electricity already has been accomplished in many of our towns and cities. The day seems to be near at hand when this marvelous agent will be still more extensively employed in connection with pleasure carriages and vehicles of all kinds. In fact, the electrical omnibus now exists in London and has been illustrated in these columns. Independently of the greater convenience of such vehicles, the removal of horses from the streets will be a boon to the public, thereby preventing the accumulation of filth and promoting the general health. In New York and Brooklyn the air is at present contaminated with the daily droppings from some fifty thousand animals. This manure, in the form of fine dust, pervades every nook and corner of the dwellings, penetrates the clothing, and enters the eyes, ears and nostrils of the inhabitants, forming irritating centers from which diseases result. The electrical wagon will bring many advantages to modern civilization.

A NEW MAP OF THE PLANET MARS.

The close resemblance, in so many details and conditions, of the planet Mars to the earth has long made it one of the most interesting of the heavenly bodies, and speculation as to whether or not it is inhabited by beings similar to those living upon the earth has been long indulged. On the 3d of August the planet was closer to the earth than it had been at any time during the past fifteen years, and its unusual brilliancy for the week prece ing caused it to be observed with the utmost attention at most of the observatories in the world. The great Lick telescope, at the Mount Hamilton Observatory, California, was used to its full capacity in this work, and for several days observations of the most valuable character were obtained, the near approach of the planet, and its consequent brilliancy and size at this time enabling the observers to utilize the full powers of the instrument with the most interesting results.

A correspondent of the N. Y. *Sun*, writing from the observatory, under date of July 31, says: The drawings by all the astronomers exhibit numerous changes in the principal characteristics since the celebrated sketches made by the Milanese astronomer Schiaparelli. Many of his almost fanciful details are shown to have no existence in reality. None of the so-called canals are doubled, or geminated as he depicted them. All of these curious streaks, whatever they may be, are broad strips, and not narrow lines, just as they were seen through the Lick telescope two years ago, and in fact just as they have been ever since the great Washington refractor was first turned on the planet in 1874.

This will be a disappointment to those who have found in the existence of these canals, and particularly in the announcement that they all were seen to be doubled, indisputable evidence that Mars was inhabited by human beings. The most startling of all the Mount Hamilton observations are those made on the two tiny moons of the planet, which were discovered by Asaph Hall in Washington during the apposition of 1877, and which have since been seen at brief intervals and only in the largest telescopes. Not only have these little attendants, by all odds the faintest planetary bodies to be seen anywhere in the sky, been in plain view for the greater part of July, but the astronomers regularly observed their eclipses in the shadow of Mars.

It was learned from Prof. Holden that the satellites are seen to disappear in eclipse upon reaching the line of shadow with almost the same instantaneous effect which is seen when the dark limb of the moon passes over a bright star in the sky. Within two-tenths of a second the whole body of the moon is seen to be immersed in the shadow cast out into space by the globe of Mars.

It is almost impossible to convey a proper idea of the insignificant size of the little satellites, or of the extraordinarily small scale upon which their orbits are drawn. The inner satellite is probably about eight miles in diameter, the outer one about twenty. The first is less than 4,000 miles from the surface of the planet and the other about three times that distance. To a man in Mars they would each appear about one fifth the size of our full moon, and they revolve so rapidly about the planet that the inner one appears to move through the sky from west to east, and consequently rises in the west. It completes one revolution in less than eight hours, so that it seems to be "new" three times a day.

It has only been possible heretofore to estimate the size of these bodies by comparing the amount of light reflected by them with that reflected from the planet Mars itself, whose size is known. But now, by means of these eclipse observations, we have a direct measure of the size, since it is found that each of the satellites moves its own diameter in about two-tenths of a second, and we can easily tell from our knowledge of their orbits just what space in miles each of them moves through in that time.

MOSES S. BEACH.

The death, at Peekskill, N. Y., July 25, of Mr. Moses S. Beach, though it had been for some time looked for, brought with it a sense of the temporary character of even the most lasting of human friendships—a realization of the transitoriness of life's longest associations. For nearly half a century, or for about the whole period of time which has marked the life history of this paper, Mr. Beach was, until stricken by his last illness, a familiar figure in our office, and he always brought a friendly countenance, the air of one living an active and useful life, and a keen appreciation and sound judgment of the intricacies and problems of many branches of business.

Mr. Beach was in his 70th year, and his death was from paralysis, with which he was stricken three years ago, since which he had been living in a helpless state on his country place at Peekskill. He was an older brother of Mr. Alfred E. Beach, one of the proprietors, and at present, as for many years past, an active working editor of this paper. The two brothers were for several years owners in partnership of the New York *Sun*, Moses S. Beach finally selling this property to its present proprietors.

Although Mr. Beach was known principally as a business man whose full time was always needed for the proper direction of his varied and important interests, he yet found the opportunity to be considerable of an inventor, as shown by the records of the Patent Office, where a half score or more of patents appear in his name. They related principally to printing and stereotyping—the feeding of roll paper instead of flat sheets, apparatus for wetting the paper before printing, cutting off the sheets, etc. Some of his inventions in this line facilitated the adaptation of newspaper presses to the printing of both sides of the sheet, while

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the paper was passing once through the press, now an indispensable feature of all fast newspaper presses. In the last report of the Commissioner of Patents the name of Mr. Beach appears in a brief list which is given of American inventors who have contributed materially to the promotion of important industries.

Mr. Beach was for many years a near neighbor and stanch friend of the late Henry Ward Beecher, being a trustee of Plymouth Church, a superintendent of its Sunday school, and interested in several organized charities of the city. He was in all things enterprising and energetic, and, with an industry which never tired, his work was always directed to a plain, practical end, so that it was more than ordinarily successful. He leaves a wife, three daughters, and two sons.

Friction.

Truthfully, says our new contemporary, *Milling*, one of the unrelenting foes of force is friction; and were it not for that ever-present factor, motion would become as simple, as easy and as airy-like as are the motions of the planets, the nebula and other floating fragments through ethereal space, which meet with absolutely no frictional resistance when roaming apart from and independent of each other.

Unfortunately, however, for the plodding mechanic who is ever trying to devise means for annulling the laws of friction here on this mundane sphere, all solid substances and some that are not solid possess weight, have a specific gravity that demands a state of rest, and even the most cunning artifices of man cannot disturb that natural state of rest except by the application of force. Man may construct the most skillful of mechanical devices, hung or poised on the most delicate of centers, but they will remain perfectly still until force is applied to move them around, and when the force is reversed the natural state of rest is soon resumed. The natural laws of friction are opposed to motion and when the over-ruling force is removed, rest is ordered and rest ensues.

It is assumed and accepted as a fact among many practical as well as theoretical men that the frictional resistance is in proportion to the weight of the moving object. That is true in a modified sense only. A revolving shaft for instance, weighing one ton, may require ten times the force to revolve it that it does another similar shaft weighing ten tons.

The most popular error, however, seems to be that friction is independent of time, surface and velocity. This is a newly discussed error—but nevertheless popular. Time can never be ignored in any kind of a calculation, be it for overcoming frictional resistance or any other kind of mechanical or natural resistance. As we multiply times so do we increase aggregrate resistance, and so must we multiply force to overcome it. Friction is independent of surface in a modified sense only. If it is meant to increase or spread the surface without increasing the weight, as for instance incasing a revolving shaft in a bearing its full length, instead of hanging it in two or more short bearings, there is no sensible increase of frictional resistance to revolving it, provided the shaft is very perfectly turned and the bearing perfect. But if by surface is meant the space traveled over in a given time, then the frictional resistance increases with the increase of surface or space. Thus, for instance, if we draw our sleigh over a level piece of road at the rate of five miles an hour, and another of the same weight at the rate of 20 miles per hour, it will require four times as much force to move the latter as it will the former.

Friction is at no time, in no sense, nor under any condition, independent of velocity, weight and bearing surfaces being always the same; every increase of velocity means an increase of frictional resistance that requires an increase of force to overcome. Every decrease of velocity means a decrease of frictional resistance and a decrease of force to overcome it.

All of these variations in the laws of friction were formerly well known to all the leaders among mechanics and are yet, but errors will creep in notwithstanding. How to overcome or reduce friction has ever been a study among leading mechanics and many mechanical devices for the purpose have resulted. Also anti-friction metals for journal boxes have been quite numerous. Anything to beat friction is the motto.

The Hope of France.

French science has to deal with a peculiar problem, how to prevent the depopulation of the country, which is now going on so rapidly that the deaths exceed the births by nearly 40,000 in a single year. Increasing the birth rate having proved impracticable, the present hope is to diminish the death rate. At a recent meeting of the new Society for the Protection of Children, Dr. Rochard referred to the fact that only eight years ago he was laughed at for predicting that the population would become stationary before the end of the century, and stated that 250,000 infants die yearly, of whom at least 100,000 could be saved by intelligent care. Stringent laws have been already passed to aid in preventing this great waste of life. It is now illegal for any person to give children under one year of age any solid food except on medical advice, and nurses are forbidden to use nursing bottles having rubber tubes. Efforts are being made also to induce Parisian mothers to nurse their own infants.—*Medit. Naturalist.*

The Master Car Builders' and Master Mechanics' Conventions.

The annual convention of the Master Car Builders' Association was held at Saratoga June 15, and the Master Mechanics' Association was held June 20. The wisdom of holding the two conventions as close together as practicable was demonstrated by the large attendance at the meetings of both, 110 members attending the master car builders' convention, and over 150 members attending the master mechanics' convention, being, in the latter case, the largest attendance in the history of that association.

New presidents were elected for both associations, Mr. E. W. Grieves to succeed Mr. John Kirby as president of the Master Car Builders' Association, and Mr. John Hicky to succeed Mr. John Mackenzie as president of the Master Mechanics' Association.

Resolutions were adopted at the master mechanics' convention providing that "all car builders above the rank of general foreman, having charge of the design, construction or repair of railroad rolling stock, are eligible to membership in this convention," and that "all questions pertaining to the repair, construction or design of the rolling stock of railways, whether engines or cars, are legitimate questions to come before this association."

"Cast Iron Wheels."—An excellent report was returned by the master car builders' committee having this subject in hand. The conclusions of the committee are substantially as follows: A majority of the roads replying to the circular of inquiry use the contracting chill, nearly all agreeing that with it foundry loss is decreased; but it is evident that a cheaper grade of iron cannot properly be used, and not less than 50 per cent of new iron should be used. As regards uniformity and quality of product, no conclusion is expressed. As to whether the percentage of guaranteed wheels requiring to be replaced has been modified by the contracting chill, no conclusion is expressed, but further inquiry recommended. As to grinding and balancing wheels, no data of importance were collected.

The general guarantee of wheels is four to five years in freight service and 60,000 miles in passenger service. Time allowed in annealing varies from six to nine days, the advocates of the maximum and minimum time not being confined to either plan of chilling. A model wheel should have five-eighths inch depth of chill. Well-deserved praise is paid by the committee to the progressiveness of wheel makers for producing cast iron wheels weighing less than 600 pounds and guaranteed for 60,000 miles of the heavy, fast modern service for less cost than other car and locomotive castings. If in the year to come the committee receives the assistance and co-operation from members and wheel makers that it deserves, it is probable that its next report will contain much reliable information of value.

"Steel-Tired Car Wheels."—This committee was to report upon the relative merits of solid cast and wrought centers and of plate centers bolted to hubs and tires. The committee did the best it could with the scant information it was able to gather. About the only conclusion arrived at in the report is that bolted centers are rarely entirely free from trouble with loose bolts, and that solid wrought spoke centers are the lightest and solid cast centers the heaviest.

"Automatic Coupler Standard and Limits."—This was one of the most interesting reports presented to the convention, and its recommendations were all such as to secure greater safety and more uniformity in couplers.

"Steam Heating and Ventilating of Passenger Equipment Cars."—The report was confined to steam heating. In reading the report one is impressed with the fact that any device for use about railroads has small chance for success if it be of a complicated nature. Complications, even if efficient and for a worthy purpose, are unwelcome intruders on cars or locomotives. The general tendency is toward simplification of all details. This is desirable from every standpoint, because its results are always decrease in cost of repairs and increase in efficiency of service. This is a lesson worthy of careful study by all interested in apparatus for use on railroads. For them it is the secret of success, other conditions being equal.

"Standards of Efficiency for Airbrakes."—The prominence of the airbrake in the present stage of railroad development makes it eminently fit that the Master Car Builders' Association should take a very decided stand on the matter of the efficiency of brake apparatus and strongly insist that competing manufacturers of brakes improve their product to the highest attainable perfection before receiving the encouragement of patronage. The Pennsylvania Railroad has rendered the association a great service in offering to establish at the Altoona shops a set of brake-testing apparatus for the association and to aid in furthering the investigations.

"The Waste of Popping."—The committee of the Master Mechanics' Association on compound locomotives expressed surprise at the result of its test to determine the waste of steam through popping.

Two three-inch pops were used on the dome. The waste from these when blowing off was found to be a surprisingly large quantity. Its amount was determined by causing the valves to pop for ten minutes [steam pressure being maintained] and taking measure of the water used. . . . The quantity blown off as above was found to be not less than three boiler gauges, giving an average of 168 pounds of water or steam wasted per minute popping.

The ordinary frequency of popping of locomotives is one of the worst methods of wasting fuel that is permitted to continue in practice, and it is, generally speaking, simply the result of carelessness or bad judgment on the part of enginemen. This also is proved by the committee's report, for with the two crews of "careful and observing men" selected to run and fire the engines during the test, "in many trips the boiler pressure was well kept up to the maximum and yet no steam was blown off," although "the engines were for long periods worked to their full steaming capacity and immediately shut off for equally long periods running down hill or standing on side tracks."

"Compound Locomotive Tests."—The report of the committee of the Master Mechanics' Association on the tests of compound locomotives conducted by it is one of the most admirable contributions to engineering literature presented in recent years, and does great credit to the committee, to the association, and to the officers of the Chicago, Milwaukee & St. Paul Railway, who spared neither expense nor labor in providing everything necessary to facilitate the work of the committee. The methods of conducting the tests and drawing conclusions from the data obtained appear entirely above criticism, and it may be accepted that the report presents the most valuable and reliable information regarding the respective merits of simple and compound locomotives that has yet appeared.

The general conclusions to be drawn from the report are that compound locomotives are competent for all kinds of road service, and probably to burn successfully all kinds of fuel acceptable for simple locomotives, and that they are more economical of fuel than simple locomotives, the exact percentage of saving of fuel not yet being determined, but probably lying somewhere between 10 and 15 per cent in ordinary service.—*National Car and Loco. Builder.*

A New Climbing Locomotive.

A new invention for enabling a locomotive and train of cars to ascend steep gradients is being exhibited by Messrs Pocock & Co., London. In this device a grooved drum is keyed on the driving axle, and the groove is sufficiently wide to allow a stationary cable to be wound once round it. The drum is of the same circumference as the driving wheels, so that with each revolution of the driving wheels the drum travels a full revolution over the cable. This cable lies in the center of the track, and is secured at either end and kept in its position round curves by guides. It is shown by the model that the assistance given by the turn of the cable round the drum and the slight strain exercised at each end of the cable are sufficient to give the driving wheels the necessary grip or bite on the rails to allow them to gain the full length of their circumference at each revolution. The model now exhibited ascends a gradient of 1 in 3 and passes round a sharp curve at the same time. It is claimed that by this system the wear and tear of the cable are reduced to a minimum, as it rests on the bed of the track while the drum passes over it, and at all other times lies quite inactive.

Fast Ocean Steaming.

The steamship City of Paris, on July 28, completed the quickest voyage ever made between Queenstown and New York, her time being 5 days 15 hours and 28 minutes, and the distance sailed was 2,785 nautical miles. This beats by thirty-three minutes the previous fastest record, made by the Teutonic in August last. The City of Paris also beat all previous records for single day runs. The highest performance in this line heretofore was that of the Teutonic, last year, when she made 517 nautical miles in 24 hours, but the City of Paris made 519 miles on July 24 and 520 miles on July 26. On four consecutive days she logged more than 500 miles, and her average speed on the entire voyage was 20·48 knots an hour. The City of Paris and her sister ship, the City of New York, are soon to be admitted to American registry, when they will fly the American flag.

Wonderful Record of a Jersey Cow.

On July 21, Gen. Samuel H. Moore, of Huntsville, Ala., gave an entertainment in honor of the completion of a remarkable year's record of his Jersey cow, Signal's Lily Flag. The record shows a product of butter, 1,047 pounds ¾ ounce, and milk, 11,339 pounds, constituting the Lily Flag winner of the Derby of the Jerseys against the great Bisson's Bells, whose record was: butter, 1,028 pounds 15⅝ ounces; milk, 8,412 pounds 7 ounces.

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A NEW AND USEFUL TELEPHONE.

The necessity for a telephone which can be used for short distances and which, at the same time, can be obtained at reasonable cost, has been keenly appreciated by thousands of business men, manufacturers

Fig. 2.—THE SIMPSON ACOUSTIC TELEPHONE—HORIZONTAL ARRANGEMENT.

and others, who for various reasons have found the telephone in general use unsuited to their purposes.

Many devices have been constructed for the purpose of meeting this demand but, until recently, with only partial success. Letters patent have been granted within the past twelve months, however, to Mr. A. L. Simpson, of New York, for an altogether new and novel acoustic telephone that is receiving the hearty indorsement of all who have tested it.

The new telephone in its present perfected state possesses many features essentially superior to all other telephones for private lines of not more than two miles in length, and also for communicating from a central point with the different parts of large manufacturing establishments, public buildings, etc. Conspicuous among its advantages are promptness and reliability of service, perfect articulation at all times, and simplicity of construction. No electric batteries of any kind are used, and hence the telephone is very durable. It is especially adapted for all wishing rapid, cheap and direct communication within a distance of two miles with stables, depots, offices, banks, stores, shops, mines, warehouses, hospitals, hotels and private dwellings.

The instruments are sold outright to those desiring to use them, and thus become the absolute property of the buyer, and remove the necessity for paying the exorbitant rentals charged by other telephone companies.

The different kinds of instruments are illustrated by the following cuts:

Fig. 1 shows the telephone which is suitable to place in a window with the wire running out through the window casing—the telephone being placed on brackets.

Fig. 2 represents the same telephone with upright

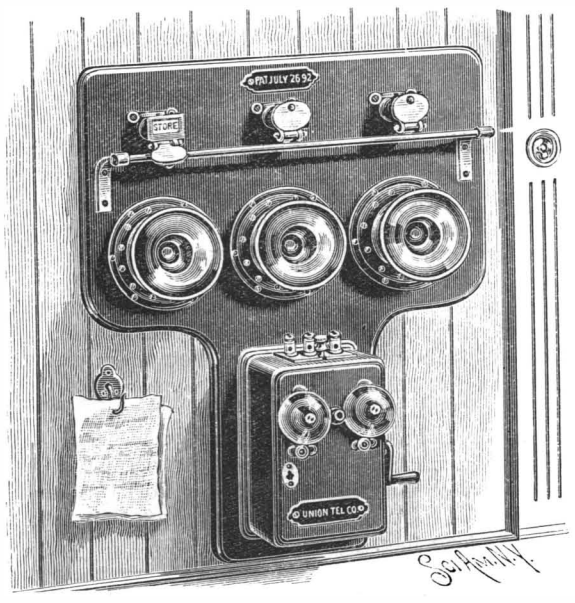


Fig. 3.—MULTIPLE ACOUSTIC TELEPHONE FOR FACTORIES.

mouthpiece, which is especially adapted to meet the wants of those wishing to place the telephone back from the window, or in any part of an office or hallway. This style of acoustic telephone is entirely new.

Fig. 3 shows the main board of the multiple-duplex system, which is to be used where several lines from different points are brought together. It will be seen there is a horizontal bar with annunciator drops over the top of each mouthpiece. When a party from a distant point desires to communicate, he simply rings his call bell, when the drop over the corresponding mouthpiece at the central board will fall, indicating exactly which line is being operated. On the other hand, if the party at the main board wishes to call any department, he throws the drop down by hand on the line which he wishes to speak over and rings the bell, when the party so called will be simultaneously notified, without disturbing any of the other lines.

All of the materials used in the construction of the telephones are of the best quality, and are assembled for durability as well as service. The essential improvements are as follows:

The frame of the mouthpiece and the diaphragm are constructed in two pieces only. The metal mouthpiece, condensing chamber, and support for the diaphragm being spun of one piece of metal, the diaphragm being bolted to this by means of small screws and bolts. The advantages so derived are essentially a collection and distribution of about 95 per cent of all the sound waves received on the diaphragm, and the avoidance of reverberation, so frequent in many acoustic telephones.

The requirements for constructing the line are very simple, and it is not at all necessary to avoid angles, all that is requisite being to keep the line free from pressure against any solid substance. To avoid this, hangers are furnished through which the line passes, and they can be so adjusted that the line can clear in going through holes in partitions and around angles.

The new telephone has many advantages, also, over the present system of speaking tubes, among them being the fact that it is much cheaper, while, at the same time, there is no necessity for defacing or otherwise injuring the walls of buildings that have been constructed without making provision for such communication, as is the case when introducing speaking tubes.

The company supplies the instruments and, when installed by its own men, guarantees everything to be in proper working order, including the lines. To those desiring to construct their own lines printed instructions are supplied which will enable any skilled mechanic or lineman to construct the telephones and lines properly.

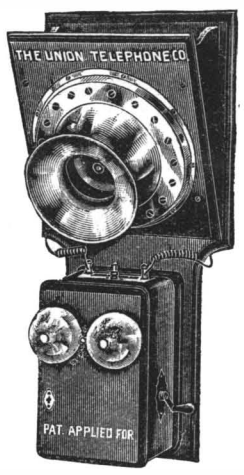


Fig. 1.—THE SIMPSON TELEPHONE.

The telephones are manufactured of highly polished metal and wood (cherry, walnut or ash) and are durable, ornamental and reliable.

The demand for this new instrument has been so extensive and its practical success so great that the company, it is stated, will soon be required to enlarge its manufacturing facilities.

We have had occasion to practically test the telephone on difficult lines, and were surprised at the clearness of articulation and the volume of sound it gives.

The telephone is manufactured by the Union Telephone Co., whose principal office is at Nos. 64 and 66 Broadway, rooms 43 and 44, where the telephones can be seen in practical operation and where further information may be obtained.

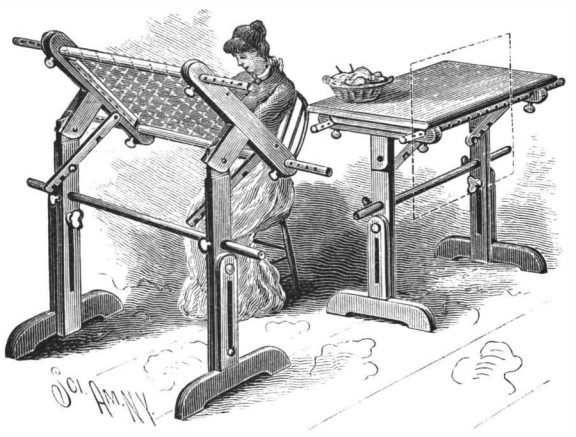
We are informed that the telephone is secured by letters patent in the United States, Germany, Canada, England, France and Spain, and the company offers for sale State, city and county rights.

A Right-of-Way May Be Built Over.

Away back in 1832 John Cowman sold lots in the block between 16th and 17th Streets, Union Square and 5th Avenue, and across the rear of lots 1 and 2 reserved 15 feet as an alleyway "subject to a right of passage for horses, carriages and carts for the private convenience of the owners of lots 1, 2 and 3, . . . and at the entrance of each of said ways into the street a proper and suitable gate with lock and key is to be kept," etc. When the purchaser bought one of these lots in 1890, he went ahead and extended the building on the front of the lot over and across this right-of-way, supporting the rear part on iron columns a foot in diameter, leaving an open space under the extension through its whole width 15 feet high and 15 feet 9 inches wide. The present owner of one of the adjoining lots tried to get an injunction against him to prevent this, but the Court of Common Pleas found that the building as erected does not prevent or obstruct the plaintiff's use of the way underneath it or beyond it. This view has been sustained by the Court of Appeals. The latter holds that while the deed says that the passage is to be "kept open," that does not mean open to the sky, or to reserve light and air for the benefit of the several lots, but only for the passage of horses, carriages and carts.

ADJUSTABLE EMBROIDERY FRAME AND TABLE.

A combined table and embroidery frame, so constructed that it may be readily adapted for use in either service, is shown in the accompanying picture. It has been patented by Mr. Maurice Schmirk, of Fayette, Mo. Upon each upright of the legs a standard or extension is held vertically adjustable by means of registering slots and a bolt and thumb nut,

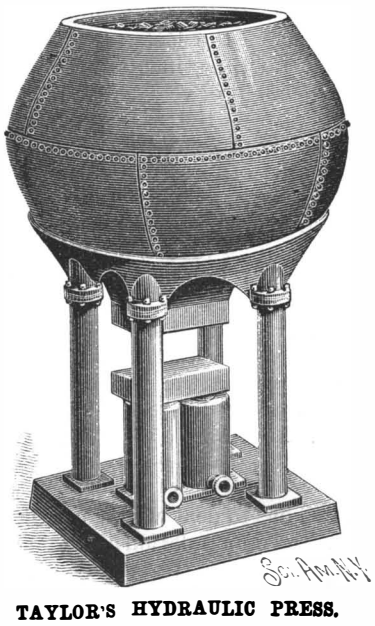


SCHMIRK'S TABLE AND EMBROIDERY FRAME.

pins upon the standards traveling in the slots of the legs. Downwardly extending arms from the end bars of the embroidery frame are hinged to the upper ends of the standards, and the adjustment of the frame to any desired inclination is effected by link bars or straps pivotally depending from the inner face of each end bar, the straps having notches adapted to engage pins on the inner faces of the standards. The end bars of the frame have each a rib provided with a series of apertures, and through the ends of each end bar pass perforated rods constituting the side bars of the frame, these rods being held in rigid engagement with the end bars by set screws. By this means, and with a similarly arranged brace bar below, the standards may be carried to or from each other to lengthen or shorten the frame, and by loosening the side rods the goods to be embroidered may be rolled up. The removable table top for use with the frame has battens on the under side near each end, provided with pins adapted to enter apertures in the end bars of the frame, and hold the top in rigid connection therewith. The table top, as well as the frame, may be adjusted at any desired inclination from the horizontal to the vertical, as shown in dotted lines in one of the views.

AN IMPROVED HYDRAULIC PRESS.

The press shown in the accompanying illustration is more especially designed for use in compressing cotton bales or other articles under very heavy pressure, the resistance being furnished without relying on the tensile strength of rods and links. This improvement has been patented by Mr. John F. Taylor, of West Park, N. Y. Hydraulic cylinders, erected upon a suitably constructed base, carry the lower platen of the press, and the upper platen is secured on the under side of a vessel of considerable size adapted to be filled with an inexpensive but heavy material, the weight being sufficiently heavy to meet all resistance required in



TAYLOR'S HYDRAULIC PRESS.

working the press. The weighted vessel is preferably supported by columns resting on the base plate, as shown.

CANE-SEAT and cane-back chairs, rockers, and settees have been for forty years a specialty with Mr. F. A. Sinclair, of Mottville, N. Y., and during that period he has always maintained an enviable reputation for the making of thoroughly first-class furniture of this description, articles which for strength, lightness, durability and neatness leave nothing to be desired.

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A NEW MILL FOR PULVERIZING.

We give engravings of two forms of mill designed for pulverizing all kinds of ores, phosphates, cements, carbon, foundry facings, plumbago, and all hard and refractory substances. Besides having such general application, this mill effects a great saving over stamp mills and other machinery for the reduction of ores and other hard substances, and, furthermore, its original cost is only about one-quarter that of a stamp mill of equal capacity.

This mill is constructed upon a new principle, which involves the use of a ring or die, on the inner surface of which a roller runs, the roller being carried by a rotating shaft hung on a universal joint. This joint is inclosed in the driving pulley, which revolves in a horizontal plane. The ring or die is inclosed in a pan in the base of the machine, and the roller carries shoes or plows, which throw up the material contained in the pan below the ring, so that it is acted upon by the roller. As the lighter portions of loose material come in contact with the screens arranged above the ring or die, they escape through the screen into the annular casing surrounding the space above the ring. In the dry mill the powdered material falls into the space below the base of the machine, from which it is removed by a screw conveyer and a set of elevator buckets. To the upper part of the screen chamber is attached a conical addition surrounding the roller shaft, which shaft is provided with a set of wings, which draw air in at the top of the conical casing, thus preventing the escape of the powdered material, and it also aids in forcing the finer powdered material through the screen.

In the wet mill, instead of discharging material into a chamber underneath the base, it is discharged into an annular trough above the base, which delivers it to the amalgamating or concentrating apparatus. In this case the fan attached to the shaft above the roller is unnecessary and is omitted.

The universal joint, which is contained within the pulley, is entirely inclosed, so as to be well protected from dust. The journal box at the top is also well protected. The frictional parts are all lubricated from a single oiler at the top. At the side of the screen chamber is arranged a hopper furnished with an automatic feeding apparatus worked by a shaft taking its power from the driving pulley.

The operation of grinding is continuous, the material being constantly agitated and thrown up, so that it is acted upon by the roller as it travels around the inner surface of the ring. As the grinding is done by the pressure of the roller against the ring or die as it travels around, no power is wasted, and the product secured is in the most satisfactory condition. It is found upon microscopic examination that whatever the nature of the substance treated in the mill, there is always a clear fracture, thus securing results that for nearly every purpose are superior to those obtained by rubbing or abrasion.

In the reduction of mineral ores, this mill leaves them in the best condition for subsequent processes.

The range of work done by this mill is very great. It operates equally well on substances as hard as flint and as soft as lime, and it will grind these substances to any desired degree of fineness.

The working parts, which are the ring or die, the tire of the roller and the shoes or plows, are readily removed and replaced, although it may be said that they have far less wear than the equivalent parts of any other mill.

This mill is made in the most substantial manner, and only the very best materials and workmanship are employed.

No exhaust fans or separate screening apparatus are required in connection with the mill, as it delivers a finished product of any fineness required.

These mills are made and sold by the Bradley Fertilizer Company, 27 Kilby Street, Boston.

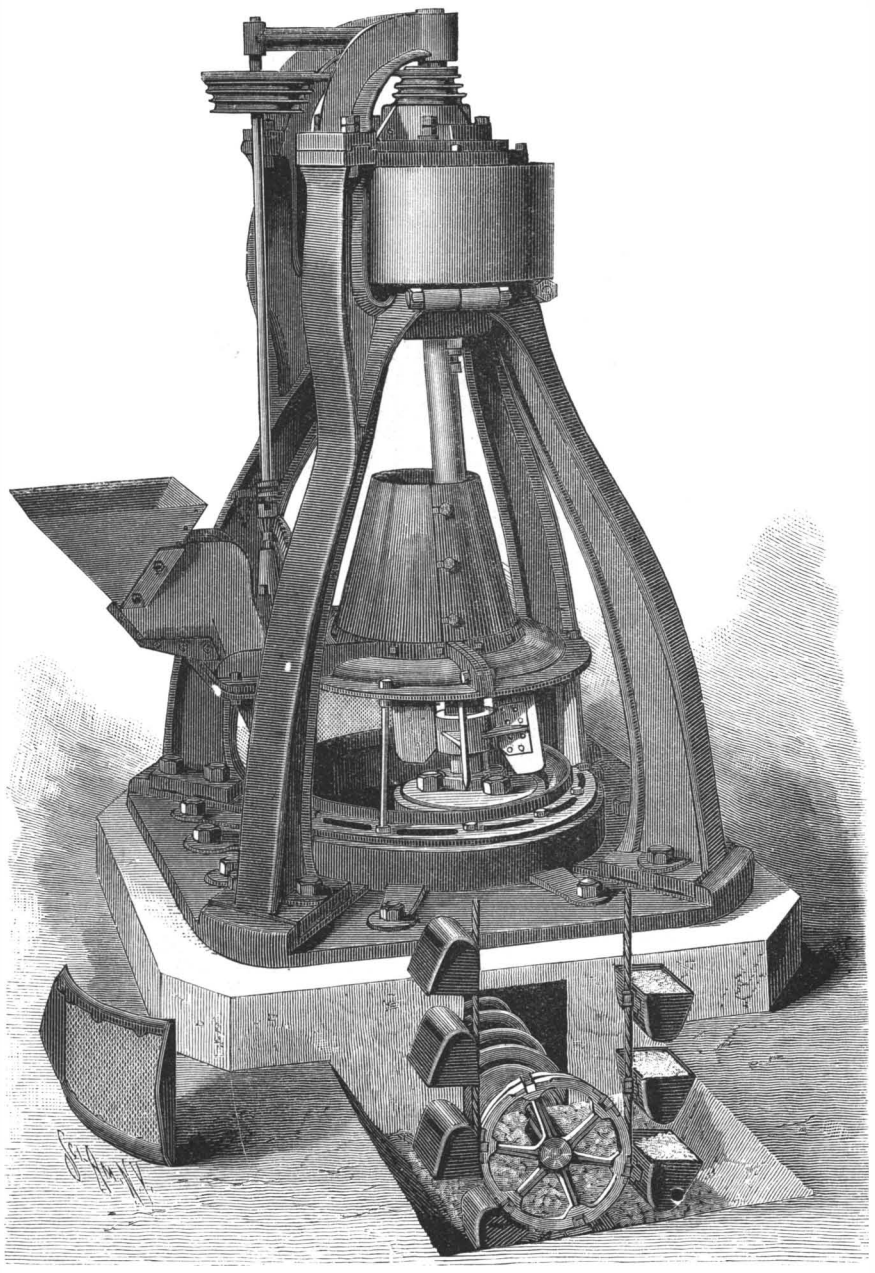

Fig. 1.—THE GRIFFIN ROLLER MILL FOR DRY GRINDING.

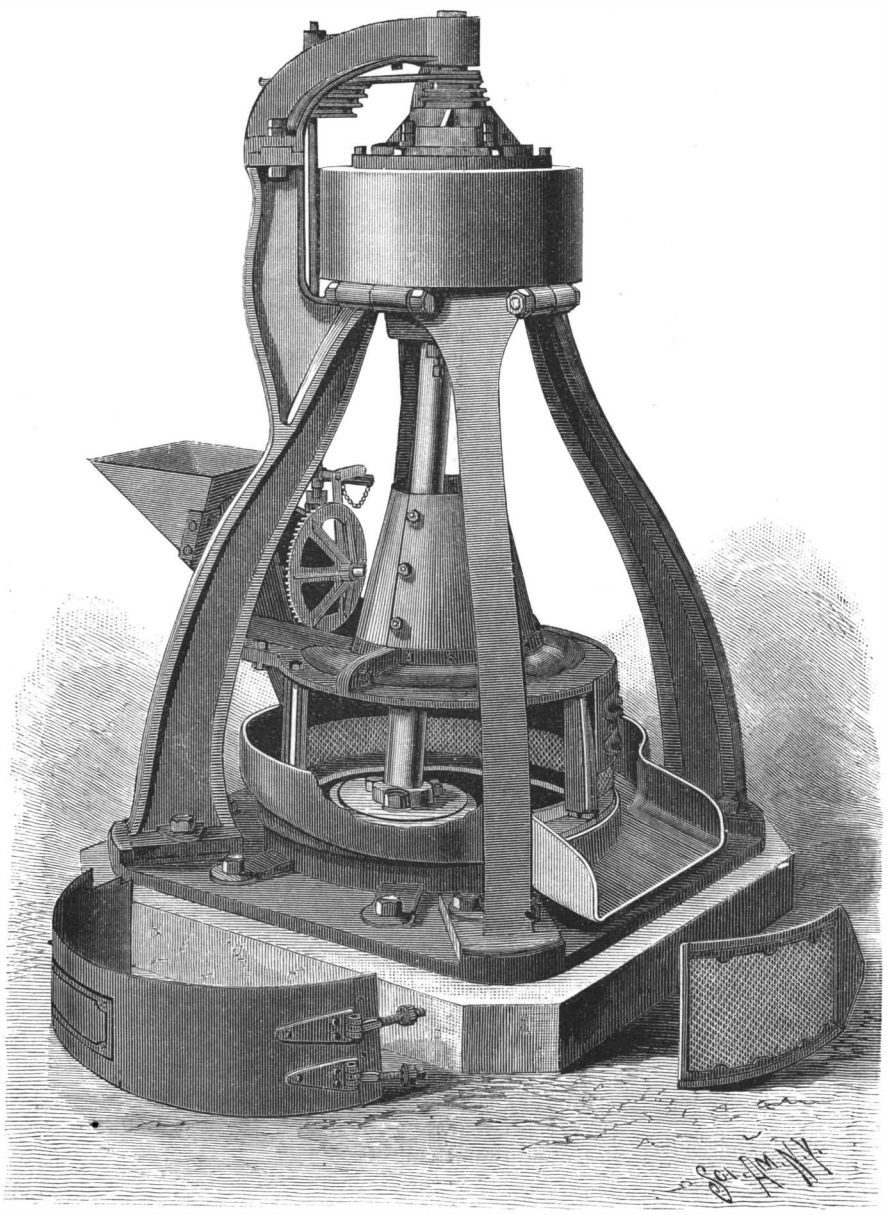

Fig. 2.—GRIFFIN ROLLER MILL FOR WET GRINDING.

Adhesiveness of Glue.

It appears that the adhesion of glue under favorable circumstances is equal to a force of at least 715 pounds per square inch. In an experiment performed, a force of 1,260 pounds, applied gradually, was found necessary to separate two cylinders of dry ash wood, the ends of which presented a surface equal to 1·76 square inch, and which were glued together end to end and allowed twenty-four hours to set. Even this weight was sustained for two or three minutes before the joint gave way, and it was found, on examining the separated surfaces, that the glue was very thin and had not entirely covered the surface. The cohesive strength of the glue appears, therefore, in this experiment to have been rather more than 715 pounds per square inch, while the cohesive strength of the wood thus united in a lateral direction was found to be only 562 pounds, thus showing that if the joint had been between the sides instead of the ends of the pieces of wood the wood would have given way before the glue. In this case, however, the glue was newly made and the season very dry, while in some former experiments made in the winter season with glue which had been frequently made, with occasional additions of glue and water, the cohesive force indicated was only 350 pounds to 500 pounds per square inch. On the other hand, Mr. Bevan found the cohesive force of solid glue to be equal to 4,000 pounds per square inch, from which it may be inferred that its application as a cement is capable of such improvement as to show a more satisfactory result than in the above-mentioned experiments. Glue that has been made a long time and kept in store is found to possess greater tenacity than newly made glue; and for the use of the joiner pale-colored glue is preferred to that of a dark tint, as it produces neater and less apparent joints. Owing to the use of a darker material and the less frequent employment of glue in joints exposed to the eye, the color of his glue is a matter of less importance to the cabinet maker.—*The Architect.*

THE quantity of heat wasted by slag has suggested projects for utilizing it in raising steam, but nothing practical has been attained until recently. At a mine in New South Wales the molten slag is run into the bottoms of iron chambers that can withstand internal steam pressure, and jets of water are forced on the slag. In a short time the chambers are filled with steam that can be utilized in other parts of the works.

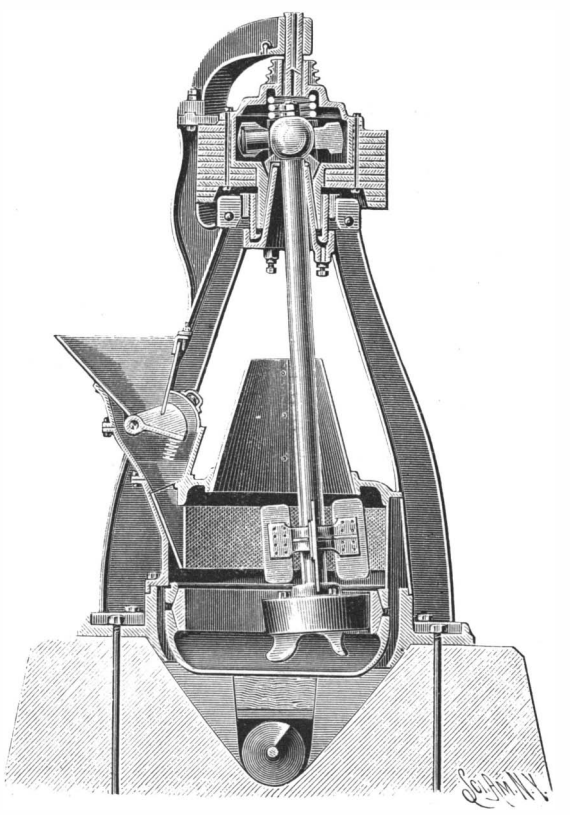

Fig. 3. A VERTICAL SECTION OF THE GRIFFIN ROLLER MILL.

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LAUNCH OF THE COLUMBIA.

Cruiser No. 12, popularly known heretofore as the Pirate, was launched from the Cramps' shipyard at Philadelphia, July 26, and was christened Columbia. The launch was in every way a success, and was witnessed by many thousand people, including Secretary Tracy, Vice-President Morton, and others prominent in the navy and in public life.

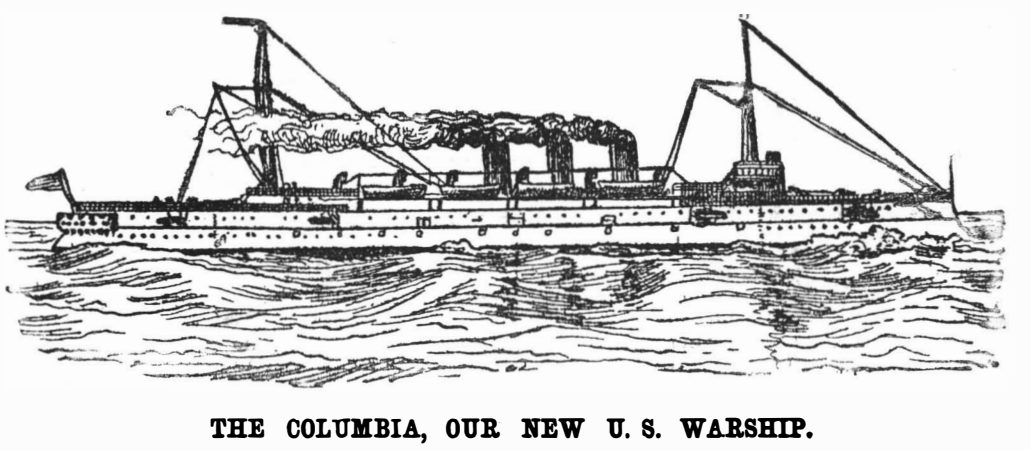
This new vessel is designed to be swifter than any other large war vessel now afloat, and she will have a capacity possessed by no other war vessel yet built, in that of being able to steam at a 10 knot speed 26,240 miles, or for 109 days, without recoaling. She also possesses many novel features, the principal of which is the application of triple screws. She is one of two of the most important ships designed for the United States navy, her sister ship, No. 13, now being built at the same yards.

The dimensions of the Columbia are: Length on mean load line, 412 feet; beam, 58 feet. Her normal draught will be 23 feet; displacement, 7,550 tons; maximum speed, 22 knots an hour; and she will have the enormous indicated horse power of 23,000. As to speed, the contractor guarantees an average speed, in the open sea, under conditions prescribed by the Navy Department, of 21 knots an hour, maintained for four consecutive hours, during which period the air pressure in the fire room must be kept within a prescribed limit. For every quarter of a knot developed above the required guaranteed speed the contractor is to receive a premium of $50,000 over and above the contract price; and for each quarter of a knot that the vessel may fail of reaching the guaranteed speed there is to be deducted from the contract price the sum of $25,000. There seems to be no doubt among the naval experts that she will meet the conditions as to speed, and this is a great desideratum, since her chief function is to be to sweep the seas of an enemy's commerce. To do her work she must be able to overhaul in an ocean race the swiftest transatlantic passenger steamships afloat.

The triple-screw system is a most decided novelty. One of these screws will be placed amidships, or on the line of the keel, as in ordinary single-screw vessels, and the two others will be placed about fifteen feet further forward and above, one on each side, as is usual in twin-screw vessels. The twin screws will diverge as they leave the hull, giving additional room for the uninterrupted motion upon solid water of all three simultaneously. There is one set of triple-expansion engines for each screw independently, thus allowing numerous combinations of movements. For ordinary cruising the central screw alone will be used, giving a speed of about fourteen knots; with the two side screws alone a speed of seventeen knots can be maintained, and with all three screws at work at full power a high speed of from twenty to twenty-two knots can be got out of the vessel. This arrangement will allow the machinery to be worked at its most economical number of revolutions at all rates of the vessel's speed, and each engine can be used independently of the others in propelling the vessel. The full steam pressure will be 160 pounds. The shafting is made of forged steel, 16½ inches in diameter. In fact, steel has been used wherever possible, so as to secure the lightest, in weight, of machinery. There are ten boilers, six of which are double-ended—that is, with furnaces in each end—21¼ feet long and 15½ feet in diameter. Two others are 18¼ feet long and 11⅝ feet in diameter, and the two others, single-ended, are 8 feet long and 10 feet in diameter. Eight of the largest boilers are set in water-tight compartments.

In appearance the Columbia will closely resemble, when ready for sea, an ordinary merchantman, the sides being nearly free from projections or sponsons, which ordinarily appear on vessels of war. She will have two single masts, but neither of them will have a military top, such as is now provided upon ordinary war vessels. This plan of her merchantman appearance is to enable her to get within range of any vessel she may wish to encounter before her character or purpose is discovered. The vitals of the ship will be well protected with armor plating and the gun stations will be shielded against the firing of machine guns. Her machinery, boilers, magazines, etc., are protected by an armored deck four inches thick on the slope and two and a half inches thick on the flat. The space between this deck and the gun deck is minutely subdivided with coal bunkers and storerooms, and in addition to these a coffer dam, five feet in width, is worked next to the ship's side for the whole length of the vessel. In the bunkers the space between the inner and outer skins of the vessel will be filled with woodite, thus forming a wall five feet thick against machine gun fire. This filling can also be utilized as fuel in an emergency. Forward and abaft of the coal bunkers the coffer dam will be filled with some water-excluding substance similar to woodite. In the wake of the four inch and the machine guns the ship's side will be armored with 4 inch and 2 inch nickel steel plates.

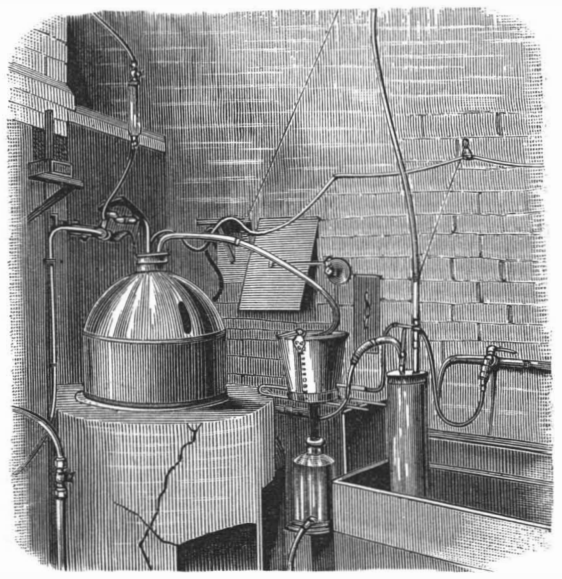
The vessel will carry no big guns, for the reason that the uses for which she is intended will not require them. Not a gun will be in sight, and the battery will be abnormally light. There will be four 6 inch breech-loading rifles, mounted in the open and protected with heavy shields attached to the gun carriages, eight 4 inch breech-loading rifles, twelve 6 pounder, and four 1 pounder rapid-firing guns, four machine or Gatling guns, and six torpedo-launching tubes. Besides these she has a ram bow. The Columbia is to be completed, ready for service, by May 19, 1893.



THE COLUMBIA, OUR NEW U. S. WARSHIP.

ETHYLENE.

The accompanying engraving, for which and the following we are indebted to the *Engineer*, represents



ETHYLENE APPARATUS.

the apparatus at the Royal Institution by which the liquid ethylene is manufactured. It consists of a glass retort, protected from draughts by an iron cover; in this retort sulphuric acid is heated to 160° C., and alcohol, heated also to 160° C., is allowed to drip into it. Ethylene and water are then given off, and run through a condensing worm in a pail of water; the water collects in a jar underneath, and the crude ethylene enters jars, in one of which impurities consisting of alcohol vapor and ether are removed by means of sulphuric acid spread over pumice stone; the sulphurous and carbonic acids also formed are removed, by passing the gas through caustic potash. The ethylene is then taken to the gasholder, in which it is stored for the supply of the pumps. The nitrous oxide used in the cooling operations is not made on the premises but purchased, as it is obtainable compressed in steel bottles in commerce. For compressing the ethylene two pumps are employed, one with a 6 in. plunger and 6 in. stroke, which forces the gas into a second pump with a 2 in. plunger and 6 in. stroke. The pumps have double valves, so that, if one valve goes wrong, the pump can be turned on to the other; this is a very necessary arrangement, especially as some of the gases used attack metal. The pumps and valves are practically without oil; they are lubricated by means of a trace of glycerine. They have Bramah leathers, and, in addition, a stuffing box. If any gas escapes the leathers, it is arrested by the stuffing box, and a pipe conveys it back to the gasholder. Water tanks on the tops of the pumps keep them cool. A splendid exhaust pump is also used on the premises; it will keep up a fair vacuum in a moderately leaky vessel. The refrigerator consists of several concentric cylindrical vessels, the outer one covered with flannel. The whole arrangement is cooled by means of evaporating nitrous oxide in the more exterior vessels; the ethylene is violently evaporated outside the central vessel, which is thus reduced to such a temperature as to liquefy air and oxygen. The nitrous oxide and the ethylene move in closed circuits, and are conducted to and from the refrigerator by pipes. The pipes which carry off the expended gases are of larger diameter than the others. The gases are thus used over and over again.

Over One Mile Deep.

The bore at Schladebach is now probably the deepest in the world, being 1748·4 meters or about 5,735 feet deep. Boring was commenced in August, 1880, and continued for 1,247 days, not counting holidays and two long interruptions in 1882 and 1883, and was completed in the autumn of 1886. The total cost of the work, the *Railway Review* says, was $53,076, representing about $9.25 per foot. The initial diameter of the hole is 280 millimeters (about 11·2 inches), and the drilling apparatus used was of the well known drop tool form, a casing being carried down as the drilling progressed. After a depth of 570 feet had been reached, boring was continued by means of a diamond drill 210 millimeters (8·4 inches) in diameter, yielding a core 140 millimeters (5½ inches) in diameter. The size of the hole was decreased at intervals, as the depth increased. At 3,510 feet it measured only 48 millimeters (1·62 inches) in diameter, and at 5,655 feet it had decreased to 33 mm. (1·32 inches). When the depth of 5,735 feet, however, had been attained, there was a succession of discouraging mishaps and operations were discontinued. Thermometric measurements in the hole were commenced in 1884 after a depth of 3,936 feet had been marked, and were repeated at every 30 meters (98½ feet) further down. These observations were made with much care, and naturally took up considerable time. The thermometers were fixed in a water chamber and this in turn was inclosed in a wrought iron casing to prevent breakage of the instruments under the enormous pressure at those depths due to the water used in clearing out the bore hole. Three thermometers were used for each reading, the mean of their indications being taken. The thermometers for each observation were left in the hole for from 15 to 16 hours. The observation showed that there was a regular, constant increase in temperature with increase in depth. At 5,628 feet the temperature was 45·3° R. (133·8° Fahr.) and there was an increase of 1° R. for every 46·09 meters (about 151 feet). From the data thus obtained the following formula has been deduced for calculating the temperature, in degrees Reaumur, at any given depth:

$$R = 8{\cdot}3 + \frac{P - 6}{46{\cdot}09}$$

in which P represents the depth in meters.

Enormous Production of Beer.

The *Western Brewer* (Chicago) has just published tables showing the total production of beer in the United States during the special revenue year ended April 30, 1892. It is seen by the official statistics that the total production of beer during the year upon which revenue was collected amounted to 31,475,519 barrels—a net increase of 1,453,519 barrels over the production of the previous year. The average annual consumption is a little less than one half barrel for every man, woman and child in the United States.

First in the list of beer-producing States is New York, with a total of 9,512,549 barrels, or more than one-fourth of the total production in the United States. Pennsylvania comes next with 3,129,733 barrels. Illinois follows with 2,888,364 barrels; then comes Ohio with a production of 2,650,205 barrels, and Wisconsin is closely in the rear with 2,605,688 barrels. Following in order: Missouri produced 2,014,086 barrels; New Jersey, 1,757, 633 barrels; Massachusetts, 1,095,966 barrels; and California, 776,050 barrels. In six States of the Union only no beer is produced at all, namely: Arkansas, Florida, Maine, Mississippi, North Carolina, and Vermont. Iowa had an output of 114,523 barrels of beer last year, an increase of 8,580 barrels over the previous year, in spite of the prohibitory liquor law. Even Kansas, setting its prohibitory code at defiance, produced 1,650 barrels of beer last year, and duly paid the tax upon it to the United States collectors of internal revenue.

In one day the human body generates enough heat to melt forty pounds of ice and raise it to boiling heat.

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THE VESSELS OF COLUMBUS.

(*Continued from first page.*)

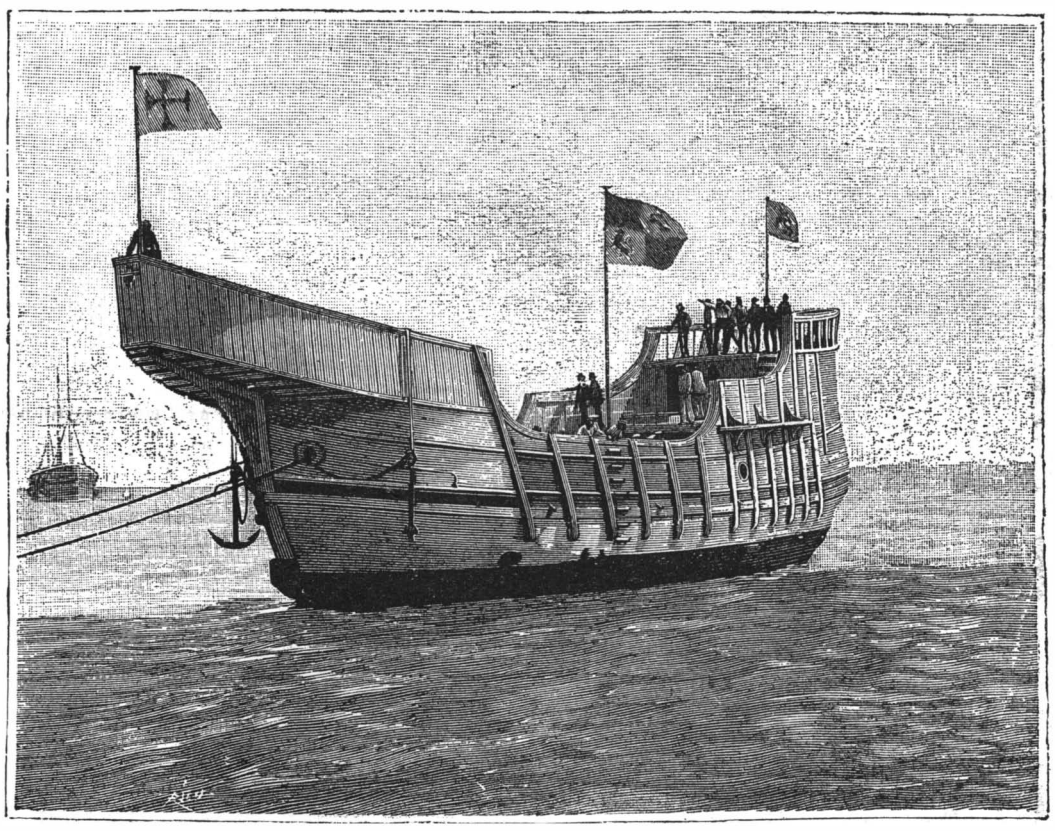
take part in the celebration which is to take place in October next. After that the vessels will sail *via* the St. Lawrence River and the lakes to Chicago, where they will constitute a feature of the Columbian Exposition.

A special proclamation has been issued by President Harrison, setting apart October 21 next as a general holiday, this date corresponding with that of October 12, O. S., 1492, when the first land of the New World was sighted by the discoverer. The President in his proclamation says: "On that day let the people, so far as possible, cease from toil and devote themselves to such exercises as may best express honor to the discoverer and their appreciation of the great achievements of the four completed centuries of American life. Columbus stood in his age as the pioneer of progress and enlightenment. The system of universal education is in our age the most prominent and salutary feature of the spirit of enlightenment, and it is peculiarly appropriate that the schools be made by the people the center of the day's demonstration. Let the national flag float over every schoolhouse in the country, and the exercises be such as shall impress upon our youth the patriotic duties of American citizenship. In the churches and in other places of assembly of the people let there be expressions of gratitude to Divine Providence for the devout faith of the discoverer and for the divine care and guidance which has directed our history and so abundantly helped our people."

The Spanish committee having the matter in charge have made careful examinations of all obtainable data to insure that the vessels shall be, in every detail which can be definitely determined, exact copies of the original Columbus vessels. In connection with this subject *La Ilustracion Nacional* of Madrid, to whom we are indebted for our first page illustration, says:

"A great deal of data of very varied character has been obtained, but nothing that would give the exact details sought, because, doubtless, the vessels of that time varied greatly, not only in the form of their hulls, but also in their rigging, as will be seen by an examination of the engravings and paintings of the fifteenth century, and as there was no ship that could bear the generic name of 'caravel,' great confusion was caused when the attempt was made to state, with a scientific certainty, what the caravels were. The word 'caravel' comes from the Italian *car a bella;* and with this etymology it is safe to suppose that the name was applied to those vessels on account of the grace and beauty of their form, and finally was applied to the light vessels which went ahead of the fleets as dispatch boats. Nevertheless, we think we have very authentic data, perhaps all that is reliable—and this data has served for the basis of operations in making the drawing which is produced in our issue of to-day—in the letter of Juan de la Cosa, Christopher Columbus' pilot. Juan de la Cosa used many illustrations, and with his important hydrographic letter, which is in the Naval Museum, we can appreciate his ability in drawing both landscapes and figures. As he was both draughtsman and mariner, we feel safe in affirming that the caravels drawn in said letter of the illustrious mariner form the most authentic document in regard to the vessels of his time that is in existence. From these drawings and the descriptions of the days' runs in the part marked 'incidents' of Columbus' log, it is ascertained that these vessels had two sets of sails, lateens for sailing with bowlines hauled, and with lines for sailing before the wind.

"The same lateens serve for this double object, unbending the sails half way and hoisting them like yards by means of top ropes. Instead of having the points now used for reefing, these sails had bands of canvas called bowlines, which were unfastened when it was unnecessary to diminish the sails."



COLUMBUS' SHIP, SANTA MARIA, RECENTLY LAUNCHED AT THE ARSENAL OF CARRACA, SPAIN.

PROFESSOR BROOKS, director of the Smith Observatory, at Geneva, N. Y., successfully observed the recent occultation of Mars by the moon. Excellent photographs were also secured of the moon and planet before and after the occultation, with the equatorial telescope.

Patents—Death of Inventor.

The United States Circuit Court for the Northern District of Illinois held, in the recent case of The De la Vergne Company *vs.* Featherstone, reported in the Chicago *Legal News*, that all the rights and remedies of inventors to the exclusive property in their inventions comes from the statutes; that the statutes of the United States recognize only three classes of persons to whom a patent can issue for an invention, viz., to the inventor himself, to the assignee of the inventor, when the assignment is made before the issue of the patent, and to the executor or administrator of the inventor, if the inventor dies before the patent is granted; and that upon the death of an inventor before the grant of a patent the right to a patent descends to his personal representatives, and if they fail to suggest his death and take the necessary steps under the statute to perfect the patent, there is no person to take the thing granted, hence the grant never can take effect.

An Acoustic Method whereby the Depth of Water in a River may be Measured at a Distance.

About two years ago I wished to know from time to time the rate at which a river was rising after a fall of rain. The river was at a considerable distance from the spot where its height was to be known. By means of the combination of two organ pipes, and a telephone circuit, described in the following lines, I have been able to make the required meesurement within rather close limits. At the river station, an organ pipe was fixed vertically in an inverted position, so that the water in the river acted as a stopper to the pipe, and the rise or fall of the water determined the note it gave, when blown by a small bellows driven by a very small water wheel. A microphone was attached to the upper end of the organ pipe. This was in circuit with a wire leading to a town station at some distance. At the town station there was an exactly similar organ pipe, which could be lowered into a vessel full of water while it was sounding. By means of the telephone the note given by the pipe at the river was clearly heard at the town station; then the organ pipe at this station was lowered or raised by hand until it gave the same note. The lengths of the organ pipes under water at the two stations were then equal, so that the height of the water in the distant river was known.

The determination can be made in less than a minute by any one who can recognize the agreement of two similar notes. The arrangement when first tested was so placed that the height of water at two places near together might be easily compared. I found that a lad with an average ear for musical sounds was able to get the two heights to agree within one-eighth of an inch of each other, while a person with an educated ear adjusted the instrument immediately to almost exact agreement. The total height to be measured was 17 inches. A difference of temperature at the two stations would make a small difference in the observed heights. For example, taking a note caused by 250 vibrations per second, a difference of 10° C. between the temperatures of the two stations (one not likely to occur) would make a difference of about 0·02 feet in the height—a quantity of no moment in such a class of measurements. The organ pipes were of square section, and made of metal, to resist the action of the water.—*Frederick J. Smith, in Nature.*

Acute Rheumatism.

There is at least one thing about which doctors agree, and that is the drug which acts most surely in acute rheumatism. Dr. M. Baudouin has made a tour of the Paris hospitals and finds that all the physicians use salicylate of soda. Some give also bicarbonate of soda and antipyrin, but salicylate is the sheet anchor. The mode of administration differs, however. Dujardin-Beaumetz gives 15 grains every three hours; Talamon, the same amount every two hours; Straus gives 45 to 60 grains in single doses twice daily; Bouchard, 75 grains of the salicylate and 150 grains of the bicarbonate of soda daily. Barth in some cases gives quinine and antipyrin, while Chauffard uses antipyrin alone, giving 60 to 120 grains daily. Barie gives 30 grains three times a day, and Comby 15 grains every two hours.

In the New York hospitals larger doses than the above are often given. In Bellevue, 20 grains every two hours, for the first day, is usually prescribed. In St. Luke's, oil of wintergreen has been much used. Salol has been given also instead of the salicylate. Nothing has yet approached the salicylates in efficacy in the treatment of acute rheumatism. It is generally the septic and gonorrhœal cases only in which it fails. But there is still a wide divergence of opinion as to how to administer the drug so as to get its effects *cito, tuto, et jucunde.—Medical Record.*

Experience with Metallic Ties in Belgium.

A summary of five years' experience with metallic ties on the Belgian State railroads is given by Mr. Janssen in the June number of the *Revue Generale des Chemins de Fer.* Two patterns, says the *Railroad Gazette*, of metallic ties were used, both of the same weight, 165 pounds, but of somewhat different cross-section. The flange rails, weighing 76·6 pounds per yard, are fastened to the ties by movable clips and bolts and nuts. There are twelve ties to a 9 meter rail. Careful observations were made on four sections of track with metallic ties and one section of track with half log, creosoted, oak ties.

It was found very difficult to keep the metallic tie track in good shape, particularly as the stone ballast was ultimately pulverized by the ties, necessitating the addition of new ballast in 1891. The metallic ties are themselves in damaged condition, owing to cracks which start at the bolt holes. Out of 240 ties of each pattern which were carefully examined, 77·5 per cent of the Braet form were more or less cracked, and 17·9 per cent of the Post type were similarly damaged.

Up to the time of making the report the track with metallic ties has cost for maintenance about nineteen times as much as the track with creosoted oak ties. Beyond this, many of the metallic ties are damaged to such an extent that they must soon be removed.

Artificial Camphor.

Mr. L. Nordheim, of Hamburg, presents the following method of preparing camphor through the action of ozone or of ozonized air upon camphene: Turpentine obtained through the distillation of the crude oil is treated with dry hydrochloric acid gas. The solid hydrochlorate is separated from its liquid isomers by pressure, and is purified and then treated with crystallized carbonate of soda in a distillatory apparatus. The temperature is raised to about 120°. The camphene obtained is so pure as to need no rectification. Ozonized air is made to act upon its vapor, and this converts it into camphor:

$$C^{10} H^{16} + O \text{ (camphene)} = C^{10} H^{16} O \text{ (camphor).}$$

The product obtained is purified by sublimation, like natural camphor.—*Moniteur Scientifique.*

RODINAL, according to the *Chemische Zeitung*, is prepared as follows:

Potassium metabisulphite	30 parts.
Para-amidophenol hydrochlor	10 "
Boiling water	100 "
Soda hydrate	q. s.

Dissolve the first two as far as possible in water and then add slowly a concentrated solution of caustic soda, until the precipitate at first formed is again dissolved, and the solution clear.

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FIRE DEPARTMENT "CUT-LOOSE."

The present illustrations represent the contrivances used by the Jersey City Fire Department for loosening the horses from their stalls when an alarm is sounded. They have two methods in use—one by the stroke of the gong and one by electricity. Illustration No. 1 represents a cut-loose that loosens the horses instantly by the dropping of a half pound weight on the end of a releasing lever. This lever releases a large bell crank, which is connected to the horse stalls by means of wire and bell crank connections. When released, the lower part of the crank is drawn downward by a spring connection. The upright part moves forward, drawing down the bolt and releasing the strap.

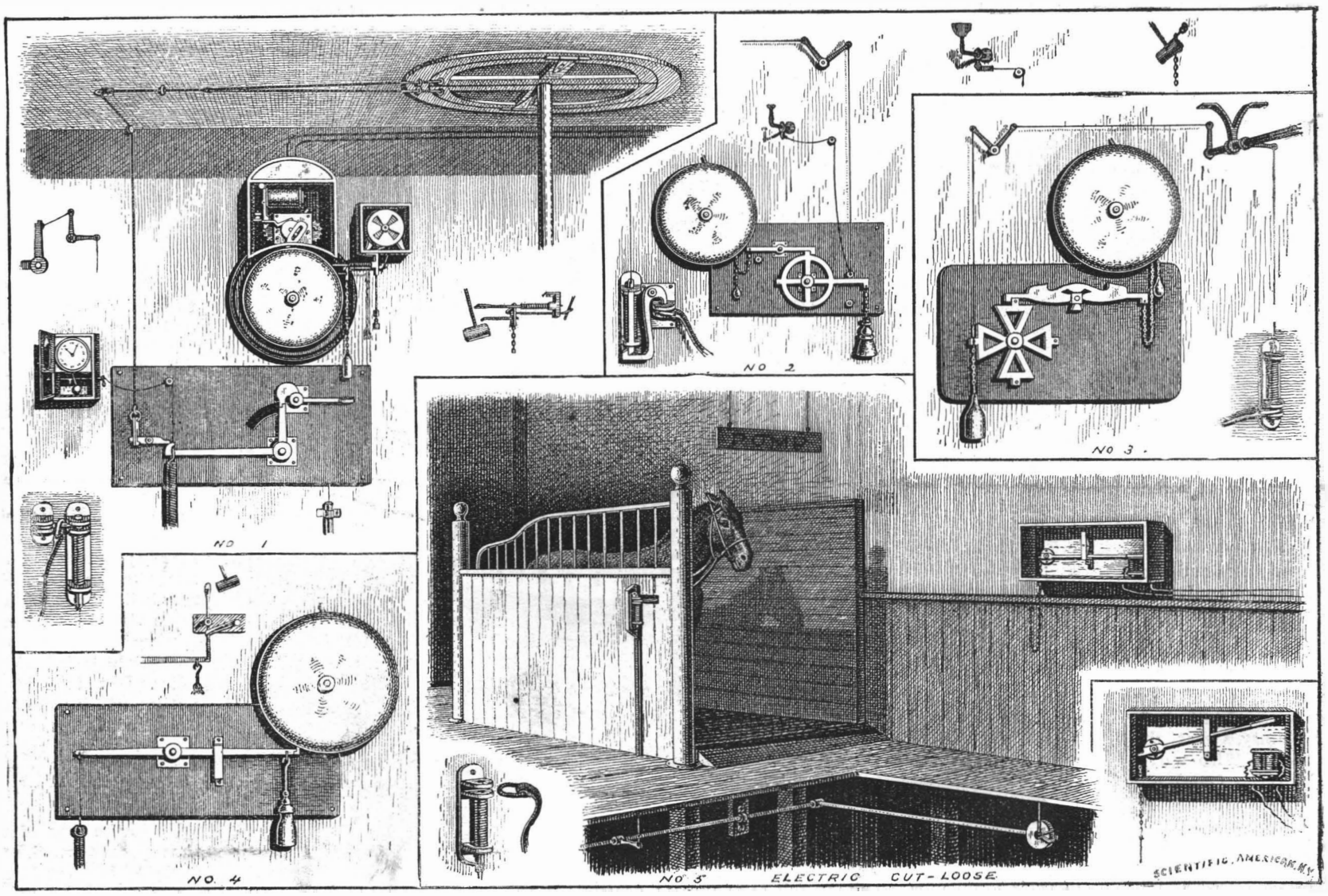
The contrivance on the stalls for holding the strap are brass-slotted castings, about 8 inches in length, 2½ inches in width and ¼ inch in thickness. One contains a bolt with a spring connection, and the other a loose pin. One end of the strap is fastened securely to the inside of stall. The other is passed through the bridle of the horse. The ring on the end of the strap is then placed on to the pins, the end of which rests in the slot back of the bolt. With the first stroke of the gong the weight falls on to the releasing lever. The bell crank draws down the bolt, and the horse starts forward, drawing the strap away from the pin and through his bridle, making himself free to run to the engine. The weight is held up in place by means of a pin passing through the end of a small piece of sheet brass attached to the end of chain. This piece of brass rests against the arm of an indicator which gives the gong strokes by means of pin pricks on paper. This arm has a spring attachment which draws the pin back in time to puncture the paper strip at every stroke. The arm of the hammer shoves the brass piece holding the weight off the pin at the stroke, starting also the indicator.

Attached to the bell crank also is an arrangement for stopping the clock and opening the sliding pole trap. The clock is stopped by means of a cord connected to the crank on one end, the other being connected to a wire running through the clock horizontally with a small piece about an inch in length soldered on to the center. One end of the wire has a small weight attached to it and rests outside of the clock on a pin. The wire is shaped so that when the alarm goes off the string pulls the weight off the pin, and the soldered piece catches the pendulum and stops the clock. The sliding pole trap is connected to the bell crank by means of a loose button.

The five-sixteenths inch trap rope runs along the ceiling and down to this button, one end of which rests on the bell crank and the other runs through a hole in the piece of brass connected to the bottom of the rope. When the crank is released by the lever the end of the button resting on the end of the crank drops down, instantly releasing the rope, which causes the trap doors to fall. No. 2 is a cut-loose where the 6 inch wheel with a weight attachment is released by the dropping of a quarter pound weight resting on the hammer of the gong. The chain which holds the weight rests on a pin which lies across the top of the hammer.

As the hammer goes forward the pin drops, the chain slides off, and the quarter pound weight drops instantly, releasing the wheel. The 6 pound weight at the end draws up the bolts at the stalls by means of bell cranks and releases the horses. Attached to wheel is an arrangement for turning up the gas at night. No. 3 is similar to No. 2, the difference being in the shape. The releasing bolts on the stalls are drawn upward by means of set screws connected to a piece of shafting over the stalls. No. 4 is a cut-loose where the back stroke of the hammer causes the 8 pound weight to fall that releases the horses. The releasing lever hooks underneath the end of the drop. After the stroke the rubber band keeps the releasing lever from falling back in the way of the hammer.

No. 5 is an electric cut-loose. When the alarm is sounded the electric current is cut off from the magnet. The 1½ foot lever flies up, instantly releasing the chain which rests on the hook at the end of the lever. The releasing bolts on the stalls are connected by wire to a piece of shafting under the flooring. The weight at the end of chain is connected to the shafting, which drops when released from the lever, causing the bolts to drop, which instantly releases the horses. These contrivances are made mostly of brass and are about from 1 to 2 inches in width, about one foot in length and ½ inch in thickness. They were made by the firemen of the department. They cost from $10 to $20 each.



FIRE DEPARTMENT "CUT-LOOSE."

An Electrical Harpoon for Whales.

BY A. M. TANNER.

It appears from a French patent, granted August 7, 1852, to Dr. Albert Sonnenberg, of Bremen, Germany, that the magneto-electric machine and accessories, forming the subject matter of said patent, had actually been used for killing a whale. This must indeed be considered a remarkable achievement at such an early date in the history of the magneto-electric machine, or more properly the dynamo-electric machine, if we accept the generic definition of Profs. Thomson and Houston that all machines for producing electric currents by mechanical force are dynamo-electric machines. It is not necessary to enter into details as to the construction of Dr. Sonnenberg's machine. It is sufficient to state that it consists of a crown or ring armed with a number of armature or induced coils turning before a number of permanent field magnets, with a current-collecting ring and brushes, so arranged as to be capable of giving "a whale 720 galvanic shocks in one minute."

The accessories used in connection with the current generator are an ordinary harpoon carrying an electrical conducting wire, covered by the harpoon line and connected with one pole of the generator, so as to form one-half of the electric circuit, the other half being formed by the metal-plated bottom of the boat containing the magneto machine and the sea water.

When the harpoon is lanced into the whale the circuit is completed, and, as stated in the description, the "electric fluid passes through the body of the whale, and the latter receives at each rotation of the machine twelve heavy shocks, and as the machine can make one turn per second, the whale will receive 720 shocks per minute, of such a force as to stun or render the whale unconscious, as has been *proved by electrical experical experiment.*"—*Electrical Review.*

Clouds as Weather Signs.

The general cloud signs penned by the late Admiral Fitz-Roy, and still incorporated in the publications of the Meteorological Office, the *Marine Record* considers still useful guides to the ordinary observer. Light, delicate, quiet tints or colors, with soft, indefinite forms of clouds, indicate and accompany fine weather; but gaudy or unusual hues, with hard, definitely outlined clouds, foretell rain, and probably strong wind. Small inky-looking clouds foretell rain; light scud clouds driving across heavy masses show wind and rain, but if alone, may indicate wind only, proportionate to their motion. These and many other general rules have long been trusted, but it is only of recent years that much importance has been attached to the relative stratum of the atmosphere in which the clouds are moving. "It is now generally acknowledged," says the *Nautical Magazine*, "that in cyclonic storm areas the wind at the earth's surface draws inward toward the central area of the disturbance, and the clouds at a medium height in the atmosphere revolve in a true circle round the storm center, while the higher clouds, such as cirrus, diverge somewhat from the center. The upper clouds in the front of a cyclonic disturbance also have a somewhat different movement relative to the center than the clouds in the rear of the storm's path; it will be readily seen that such observed facts are of the very highest importance to the weather forecaster on shore and to the sailor when in an isolated position."

WHERE instinct was stronger than both will and reason is illustrated in a story told of Darwin, who was accustomed to go to the Zoological Gardens, and putting his forehead against the glass case containing the cobra de capello, to test his will and reasoning power. Darwin was perfectly convinced as to the inability of the snake harming him, yet every time the vicious snake would strike against the glass, he always dodged back in spite of his reason and will to resist the impulse.

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ON THE RIM AND IN THE DEPTHS OF THE GRAND CANYON.

BY H. C. HOVEY.

Since the first of May there has been a revolution worth chronicling. The Flagstaff board of trade, co-operating with the railroad officials, have decided at last to make the Grand Canyon accessible to tourists. Tri-weekly coaches, with relays of horses, are now run by Wilcox in a single day to the head of the Hance trail, where a first-class hotel is being erected with accommodations for fifty guests. The news is told *pro bono publico*, and will be appreciated by those who have had to make the trip by buckboard or wagon, with primitive log cabin accommodations.

My aim in this article shall be to tell the tourist what he may expect to see at Hance's, or at least what I did see during my four days on the rim and in the depths.

But certain general facts should first be given. Eighty years prior to the landing of the Pilgrim Fathers, a Franciscan monk induced the viceroy of New Spain, in 1540, to send out an exploring party under the renowned Coronado. They discovered the lower portion of the Colorado River, and they also found the San Francisco Mountains, at whose base lies the modern city of Flagstaff. These peaks are extinct volcanoes, 13,000 feet high, girt about with minor cones, basaltic mesas, and cinder plains, beyond which were mysterious cliffs, to whose edge a party of twelve Spaniards, led by Cardinas, with Moqui guides, made their way. They found a raging river, between banks so high as to make them seem "three or four leagues in the air." Forms beckoned them to descend into the gorge, which, on approach, turned into "rocks higher than the towers of Seville."

Other adventurers must have been frightened by their report; for two whole centuries passed before the arrival of the next visitor, Father Escalante, a roving missionary, who came down from the northern plateaus, diverging for the purpose from the old trail between Santa Fe and Utah. After his visit the region was left to the Indians for three entire generations, a romantic realm of myths and legends, unknown to the geographer.

On New Year's Day, 1854, more than 300 years after Coronado's original expedition, Lieutenant Whipple caught sight of the high cliffs, and somewhat later discovered the sublime gateway of the Grand Canyon. And four years afterward, Lieutenant Ives and Dr. Newberry, with Egloffstein, topographer, and Mollhausen, artist, undertook its exploration. Their account, published by the War Department, stimulated Major J. W. Powell to make the wildest voyage ever made on inland waters. His thrilling narration bears the simple title of "An Exploration of the Colorado River of the West." Major Powell also reached the public from the platform; and the writer had the very great pleasure of hearing his lecture while the matter was yet novel to the scientific world and fresh in the mind of the explorer. R. B. Stanton, C.E., is the only one who has thus far successfully imitated Major Powell. His party, in the interests of a railroad survey, made a continuous trip by boat, in 1889-90, from the head of the Colorado River to the Gulf of California. Three men were drowned during the voyage. Powell lost two by desertion, who were killed by the Indians.

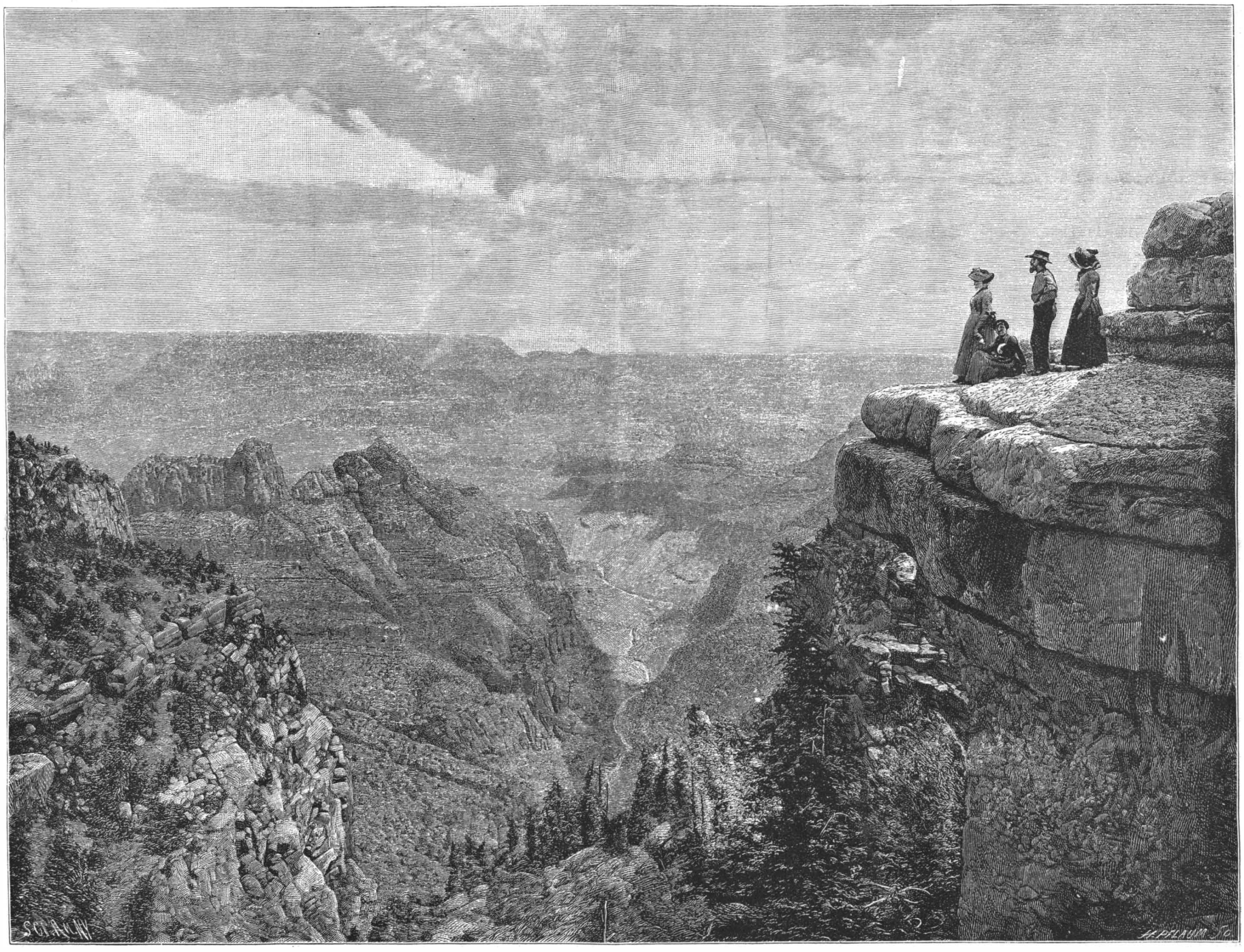
In order to appreciate the perils of such a voyage, try to think what it means to descend a stream that falls 4,200 feet in 500 miles, and that averages as many rapids and cataracts as it numbers miles! The Grand Canyon itself is 218 miles long; but the Marble Canyon, which properly belongs with it, is 65 miles in length; making a total of 283 miles of continuous canyon. Yet above these stretch away to the north other long and profound gorges, all combining to make the stupendous pathway by which the lordly Colorado goes sounding to the sea. Then there are more than fifty streams that cut through the surrounding plateaus to join the main river. And each of these has its minor canyon, that would be regarded as sublime, were it not eclipsed by the greater valley into which it empties. Each side canyon branches again and again, until you might fitly describe the Grand Canyon as a composite of a thousand gorges; and each individual gorge is a worthy rival of the famous gorge of the Niagara. Dutton's magnificent atlas, and the subsequent atlas sheets issued by the U. S. Geological Survey, though masterpieces of topography, fail to give a just idea of these vast ramifications.

Sunrise in Arizona, even amid volcanic cones, mesas, arroyas and cactus plains, has fascinations elsewhere unknown. But from the rim of the Grand Canyon the early riser may witness war between the Titans and Olympus. The friendly stars had not vanished when, alone, I mounted to the very edge of a cliff whose base was as yet invisible. My excited fancy clothed the darkness with indefinite shapes, that were mainly mingled memories of descriptions read and the moonlight scenes of the previous night. Most of these fancies were dispersed by the sheen of the rising sun, and I must confess that there followed an experience, not of disappointment, but certainly of embarrassment. My mind could not take in the mighty procession of grand objects, as one by one the sunshine touched and gilded the countless towers, pinnacles and spires, the broad red walls, royal arches and retreating alcoves, all richly carved and embellished.

For miles and miles around expanded an amphitheater, stained by all the colors from black to white, but with a rich warm red predominating. As yet I knew not the name of a single cliff, peak or formation, whether grotesque or sublime. The guide would tell me, by and by; but I was not quite ready to have such glories labeled. Across the chasm ran the crest line of a palisade till it cut the horizon. They told me afterward that it was Powell's Plateau. It did not seem so very far away, till the intervening details began to be noticed.

I knew that the dots on the brink of a much nearer wall were great pines instead of the clumps of sage brush that they might be taken for. I knew that the rift, far, far below, into which the sun shot a ray at that moment, was a deep inner gorge with walls a thousand feet high, and that the silver ribbon winding through it so peacefully was a river strong and rushing, and that the faint murmur wafted upward was the roar of a mighty torrent. The eye wandered, with a kind of helplessness, up and down the new vistas opening in every direction, and scanned the splendor and elegance of the ramparts, colonnades, and balconies of nature's temples and palaces, till the overburdened mind recoiled; and it was with a sense of positive relief that I was brought back to prosaic and practical matters by Hance's loud summons to breakfast.

My guide for the day was a Frenchman, Louis de Bouchere, intelligent, obliging, and not too talkative. The night winds had blown most of the snow from the rim into the gullies and ravines, and we had no difficulty in walking. For half a mile we followed the



THE GRAND CANYON OF THE COLORADO, FROM A POINT ON THE HANCE TRAIL.

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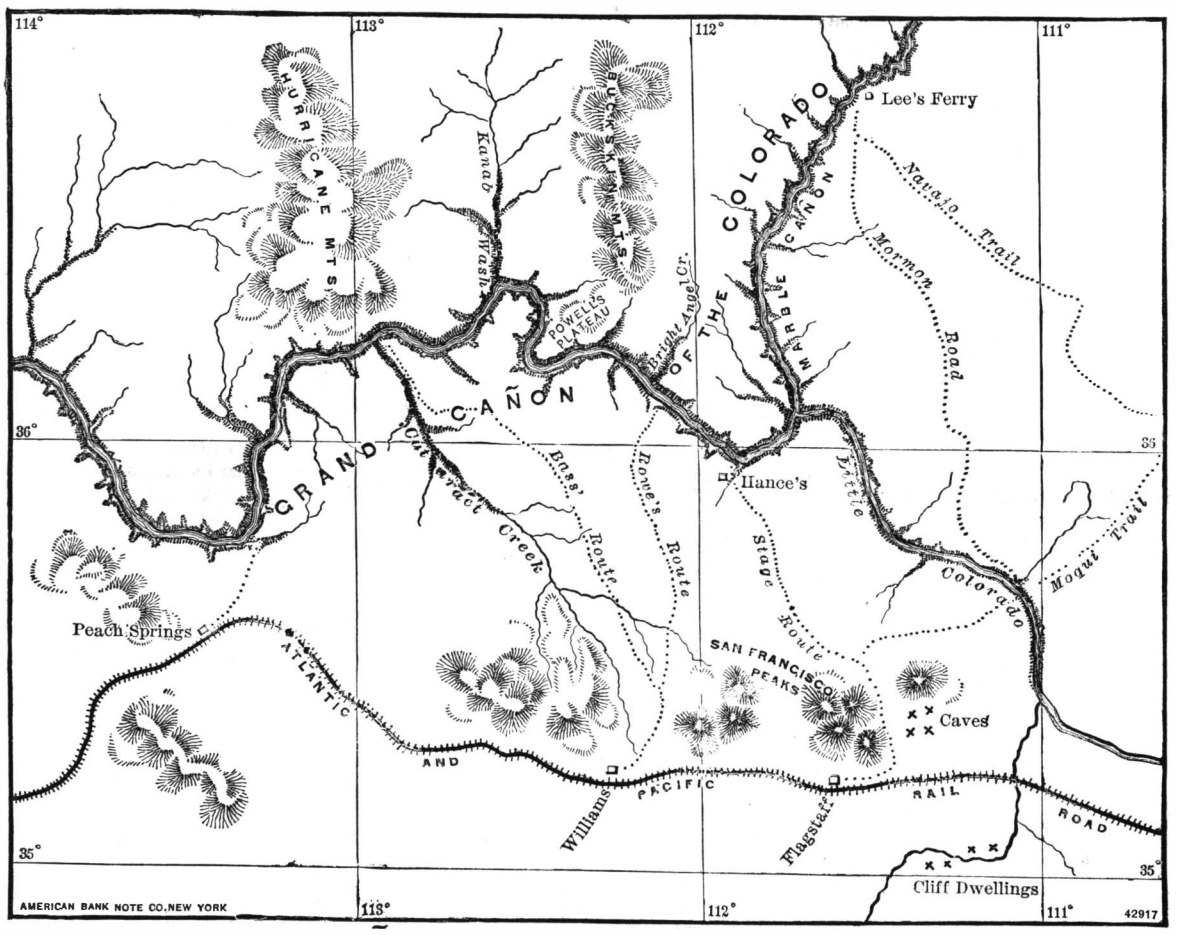
shallow valley that finally deepens into what the geologists last fall decided to call "the Congress Canyon." But just before reaching the outlet we turned abruptly away to the right, and plunged into a thicket of junipers, pinyons, and various shrubs and vines with Mexican names. We were out of sight of the canyon, but were curiously conscious that at any time a few steps taken to our left would bring us to its awful verge. The soil seemed everywhere fertile, and with proper clearing and irrigation might readily be cultivated to the very rim; thus yielding a supply of fruit and vegetables for the projected hotel.

After a tramp of about five miles we suddenly came to the Red Canyon, which led to a remarkable promontory jutting into the Grand Canyon itself. At some remote period the aborigines chose this, with rare good taste, as the location of two watch towers, each on a bold crag, whose face is a sheer precipice of fathomless depth. The pines growing in the castle courts seem to drop their cones into empty space. We thought that a bowlder hurled from the cliff had lodged in some rift, until after a long interval came back the thunderous echo of its fall. Notches fifty feet deep, between the crags and the mainland, make an approach difficult. One ancient castle has been laid in ruins; but the well built walls of the other have defied the storms of centuries. Search amid the environs brought to light many fragments of water jars, rich with interior decoration, but with a plain exterior.

Another walk of five miles brings one from Castle Point to what the writer designated as Point Eternity, on account of the boundless panorama commanded from its pine-clad cliffs. The view is almost identical with that painted by Dutton from Point Sublime, only seen from the south instead of from the north. Here let us correct an error into which many Arizonians have fallen, who take it for granted that Point Sublime is a peak rising from the depths; whereas Dutton describes it as a long promontory jutting out from the Kaibab front. (Tertiary Hist. G. C. Dist., page 141.) The vertical depth from the extreme verge of Point Eternity to the boiling river that winds in and out far down in the inner gorge has been lately measured, and found to be 6,675 feet. The eye follows the channel up stream until it joins the "box canyon" of the Little Colorado. Still above the junction extends far toward the north the majestic Marble Canyon. Scanning the horizon to the extreme west we descry the Kanab Wash, which cuts down from the summit of the Buckskin Mountains to the drainage level. And along the northern rim, we also identify Galena, Willow, Dry, Iron and Clear Creek Canyons, besides the Bright Angel Amphitheater, fifteen miles long, and whose walls are 5,000 feet in height.



MAP OF THE GRAND CANON REGION OF THE COLORADO RIVER, IN ARIZONA.

0 5 10 15 30 60
Scale of Miles.

From the miners, who found names necessary to secure claims, we obtained the following names of side canyons along the south rim that are now first published. Red Canyon lies between Point Eternity and Ayer's Peak. Then comes the Hance (or Congress) Canyon, down which runs the Hance Trail. There follow in the order given, the Aspen, Grape, Sweet Water, Lone Tree, Silver, Pipe Creek, Indian Garden, Big Horn, Salt, Monument, Hermit and Long Canyons, all visible from Point Eternity. Next below is the Cataract Canyon, hidden by the intervening hills, but accessible by the trail from Williams.

But what idea do mere names give? The very word "canyon" is misleading and unfortunate. We think of a canyon as a narrow gash in the earth's crust, from the bottom of which the sky, if seen at all, looks like a bit of blue ribbon. There are many such ravines, but they are as unlike the Grand Canyon of the Colorado as Hance's log cabin differs from the Vatican. The Grand Canyon is more than a mile deep; but its width varies from five to eighteen miles, and this immense valley is filled with every fantastic form and vivid color conceivable. It contains not only hundreds of smaller canyons, but countless terraces and lofty peaks. According to Major Powell, it might be possible to follow one narrow shelf for 1,000 miles; and to trace the winding terraces of the general valley throughout its 218 miles would require a journey of 4,000 miles. Imagine Mount Washington torn from its roots and hurled down from Point Eternity, the astonished beholder could still gaze across its base to Point Sublime, with an unobstructed view. Hills already rise from the depths of this wondrous valley higher than the tallest peaks of the Blue Ridge. And, as if to complete the matchless and indescribable spectacle, after these depths were excavated in all their grandeur, torrents of lava burst forth from the surrounding volcanoes, and repeated cloud bursts and tornadoes have, even to this day, made havoc of what was already wild beyond our wildest dream of the final catastrophe.

Friends kindly warned me that the descent into this enormous gorge would overtax any one except a mountaineer or a hardy geologist. But, encouraged by Bouchere, I resolved to make the attempt; and by taking plenty of time for it, the task was by no means exhausting. Hiring a pair of sturdy burros, one for the pack and the other for the saddle wherever riding should be found practicable, we boldly crossed the rim. Bouchere took the lead, Johnny and Jenny followed, and the writer brought up the rear. Stout mescal stalks served us for alpen stocks. The snow drifts under the rim were disagreeable but not dangerous, as they were a month previous when the guide was caught on a ledge between two rival avalanches. After a while the narrow footpath became dry and hard, and although exceedingly steep and zigzagging in every direction, was uniformly firm under foot.

The ridiculous is neighbor to the sublime. Our burros ran away. Tripod and camera were flung to the verge of a cliff, whence they were with difficulty recovered. Fainter and more faint grew the tinkling of the burro bells, as the wearers scampered headlong down the path we had to tread with such caution, scattering our outfit as they went. An hour later we found the creatures quietly browsing on bunch grass amid the cedars, as if their conduct had been altogether orderly. These sure-footed animals occasionally come to grief. Not long ago, in just such an escapade, the mate of our burros fell from a cliff 300 feet high, and broke every bone in his body.

Those who descend into the canyon lose sight of the boundless wilderness of grandeur at which it seems a sin to point an impertinent little kodak, and really gain something by having single objects of interest brought to view in their turn. Here and there are water-worn ways, now utterly dry, but over which once tumbled mighty cataracts. Near one of these places we found large cavities filled with red pigment that had probably been resorted to for centuries by the Indians. Three miles down from the head of the trail we reached a grove of cottonwood trees, watered by a perennial spring, issuing from an adjacent cavern. The banks were gay with tropical flowers. Countless cacti were in bloom, conspicuous among them being the prickly pear and the giant mescal, which grows here to the height of fifteen or twenty feet. Beside the stream a rock cabin stood, whose rafters were mescal stalks, and whose canvas roof was anchored by heavy stones lest it should be blown away. This part of the canyon is locally termed the "level," and from here to the river, some use can be made of the saddle. Grass is plentiful, on which numerous horses and cattle had been fattened during the winter, for as my guide assured me it was perpetual summer around the cottonwood cabin. The miners farther down the canyon planted gardens and lived in the open air at a season when the plateaus are white with snow. They admitted that there was an occasional frost, but not enough to prevent their raising melons, tomatoes and other vegetables before the rest of us had doffed our furs.

As to the results of canyon mining, it may be stated, in brief, that no assays have yet been made of the ores extracted, but lead, silver, and copper are certainly abundant, and there is much nickel. Great quantities of asbestos are found. The existence of other valuable minerals is indicated. Some twenty openings have been made in the line of what they call "assessment work," and Mr. McClure, and his comrades, regard the diggings as the richest they have ever seen.

Amid my novel surroundings sleep seemed impossible during our first night in the depths. The gale that swept up the gorge was terrific at times, yet our cabin stood the strain. Meanwhile the sky was azure and the full moon flooded the mighty walls with silvery sheen. A bright planet hung above a tall cliff at our right, and the stars in Orion's belt guarded another on our left, looking like electric lights along the ramparts. The hues that had seemed glaring by day were exquisitely softened, while the recesses not touched by the moon were enwrapped in solemn grandeur. Long after midnight I fell asleep, to awaken by dawn, thickly covered with the white ashes blown from our fireplace by the gale, but eager for the experiences of another day amid the depths.

When on the rim we were on the Aubrey limestone, which continued for the first 750 feet vertically, followed by 250 feet of Aubrey sandstone, which together constitute the cliff. Then came 1,000 feet first of Aubrey shale, succeeded by 2,000 feet of massive red limestones, of the Carboniferous system, shading into Devonian and Silurian rocks. The summit of the red wall series forms the main terrace, and its edge is the main cliff.

Below our cottonwood cabin we came to mottled Cambrian shales, 1,000 feet thick, under which is the Tonto sandstone, 300 feet, also Cambrian. At the junction of the Congress and Aspen Canyons our way lay through beds of enormous bowlders, above which towered cliffs and pinnacles of the various formations named above. Here the canyon began to "box in," *i. e.*, the walls approached each other and were precipitous, but presently opened into a great sandstone amphitheater, named Gabriel's Cathedral, strangely weathered and carved into noble panels. Under its arches are ancient Indian works, fireplaces where they roasted the roots of the mescal, and also mounds that the guide assured me were graves.

Below the cathedral is the "granite," of which the miners have so much to say, as holding the veins from which they hope for a metallic harvest. The granites and schists are highly tilted, and the channel winds and twists through them, tumbling over several cascades in order to join the river. One must either descend these by rope ladders or follow the longer miners' trails that are practicable for burros. The entire length of the Hance trail, from rim to river, is seven miles, and Hance himself claims to have been down and back in nine hours. But the ordinary tourist will find it a full day's work, and will do well to go down one day and return the next.

One would think that the scenery here would grow monotonous by its very excess of grandeur. But this is not so. The ever-varying light makes kaleidoscopic effects. You think you have fixed some charming view in memory forever; but even as you gaze the scene changes. These rapid transformations set cameras at defiance. Yet meritorious work has been done by Osbon, a Flagstaff artist. Taber, of San Francisco, Jackson, of Denver, and others have some fine views.

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The best are those taken by the governmental survey and that are on exhibition in the National Museum.

Our upward journey from the Cottonwood Cabin was begun under the scorching blaze of noonday. We proceeded at a leisurely pace, often pausing to admire some gay bank of tropical flowers, to inspect some rare plant, or to examine some attractive glen or cave. How grateful were the groves of junipers, with their cool shade! We are in no hurry. We listen to the marvelous stories the chasms around us have to tell as to their creation. The task of erosion began ages ago, when the general surface was near the sea level. The shallow channels were deepened as successive upheavals made faults in the strata, and gradually lifted the plateaus to their present height of from 6,000 to 9,000 feet, without destroying their geological horizons. Nature is now resting. There are no rending earthquakes here, and the volcanic fires are extinct. The forces at work are the perennial streams, aided by the winds and the sun's heat, the melting snows, and occasional cloud bursts and electrical storms.

Slowly we pursued our tortuous path amid scenery perpetually changed by the shadows cast from the remote pinnacles and nearer crags. The ruffled escarpment far above us glowed as if in some conflagration; but as the afternoon wore away, its scalloped edges lost that fierce glare and were graciously tinged by the ruddy sky. Are those masses of royal purple, rose color, lemon color, olive green, and vermilion simply hard rocks? They are more like sunset clouds. We are climbing through an enchanted realm. As evening approaches, the colors die into sober gray. The long ravines seem to fold their wings about the gorgeous temples to await the dawning of a new day. Darkness settles over the vast abyss. We hasten lest we, too, should be enwrapped in the black mantle. And when we finally gain the rim, and turn to take our last look at the Grand Canyon, its glories are hidden amid the nocturnal gloom.

The accompanying map of the Grand Canyon region was drawn by me on a much reduced scale from the most recent atlas sheets prepared by the U. S. Geological Survey.

The Coming Bee.

J. EDWARD GILES.

An article on "The Desirability of Producing a Larger Race of Bees," which was published in the *Apiculturist* for March, suggested the possibility of securing a cross between our common races of bees and the recently discovered "giant bees" of India, in such a way as to produce a new race which should combine the desirable points of both parent races.

The particular advantage hoped for from such a cross would be to secure a race which would be able to gather honey from red clover and perhaps from other flowers which now go to waste, so far as the honey crop is concerned, because the bees which we now have are unable to reach the honey. An experiment of the United States Fish Commission on the breeding of fish suggests to me still another possibility in the breeding of bees. According to a recently reported interview, Mr. D. E. Crawford, of the United States Fish Commission, stated: "We have little doubt now that before two more years we shall have evolved what the seaboard public has been clamoring for for so many years—the boneless shad. Of course I don't mean a shad that is actually boneless, but one that will be to all intents and purposes as boneless as the flounder of this country or the sole of England. This will have been accomplished by the cross breeding of the shad, the flounder and a peculiar edible jelly fish which is a staple food among the seacoast natives of Japan. . . . Our experiments, while at first rather discouraging, now leave but little doubt of turning out successful. At first the crossing resulted in the production of a lot of jelly fishes with an elaborate outfit of bones, which was just what we did not want, but time and study showed us our mistakes, and now we have a few hundred half-grown shad with less than 18 per cent as many bones as the ordinary sort.

A few years ago, when the belief in the unalterability of species both of animals and plants was generally accepted, the attempt to alter the bony structure of the shad would have been regarded as a hopeless undertaking, but now that so much has been accomplished, no one can say what the limit of possibility is. Professor Goodale, of Harvard University, predicts the time when fruits of all kinds will be produced without seeds. There is ground for hoping that this result may be attained in the fact that the banana regularly grows without seeds, or rather with only rudimentary seeds which appear as dark specks in the fruit, and so do not interfere in the least with our enjoyment of eating the fruit, and if these rudimentary seeds are planted in the ground, they refuse to germinate. Occasionally also an orange is found without seeds, and there are many other facts which give good reason to believe that before many years we may enjoy the pleasure of eating seedless fruits of several kinds.

If we are to have boneless shad and seedless fruits, it does not seem too much to hope that we may also have a race of stingless bees. It is said that there are at least two distinct races of stingless bees in South America, but these races have not much value as honey gatherers, and moreover they build combs with very thick-walled cells, and probably they would not be worth cultivating as compared with the European, Asiatic, and African races; but there is apparently as good reason to hope that these races may be used to give their one good quality of stinglessness to our common races as there was that the flounder and Japanese jelly fish could be used for the improvement of the shad. If we can cross our present races of bees with the giant bees of India and obtain a race with long proboscis and perhaps increased size (if that should prove to be of any advantage), and cross this improved race with the South American stingless bees, and by these crosses secure a race with all the good points of the Italian bee, with the additional feature of a lengthened proboscis and with the sting taken away, we shall then have a race of bees which it will be difficult to improve. It might be desirable to improve still farther by breeding out the swarming instinct, and there appears to be no reason why the swarming instinct cannot be bred out of bees as thoroughly as the sitting instinct has been bred out of certain races of domestic fowls, but now that swarming can be so thoroughly controlled by the use of queen traps and automatic hivers, this point is not as important as it would otherwise be.

Of course no one knows as yet whether it will be possible to secure a cross between our common races and those of India or South America, and no one knew whether a cross could be secured between the shad and the flounder until the experiment was tried, but now that the experiment has succeeded, the process seems so simple that we wonder why it was not done before.

It seems to me that this matter is of sufficient importance, and the prospect of success sufficiently great, to justify the agricultural department of the United States in undertaking the cost of the experiments. The cost to the government would be trifling in comparison with the benefits which would be gained if the experiment should be successful; but very few individuals who are competent to do the work would have the means to carry out the experiments at their own expense, because a residence of a few years in South America would perhaps be necessary in order to study the habits of the stingless races in their native country, and to do this it might be necessary to domesticate the bees if this has not already been done.

I have not seen the statistics of the last census; but according to the census of 1880 the honey crop for 1879 amounted to twenty-five million pounds, or about half a pound for the year to each inhabitant of the United States. At an average price of ten cents per pound, the value of the honey crop for that year would be about two and one-half million dollars. If we had a race of stingless bees, the value of the crop would soon be doubled, for many would be induced to go into the business of bee keeping who are now deterred by fear of the stings or who live in thickly settled villages, and hesitate to keep bees for fear that their neighbors will consider their pets a nuisance. Even in the oldest and most thickly settled States the number of bees could easily be doubled without exhausting the honey supply, and in suitable places by planting special crops there is no limit to the amount of honey which could be produced. Some may argue that an increased supply of honey would mean lower prices, and that since it is not easy to find a market for the present supply, it would not be possible to dispose of a larger quantity; but experience shows that as the supply of any article of food increases, the demand always keeps pace with the supply. In the memory of men who are not yet very old, it was formerly very difficult to find a market for tomatoes, but I remember a few years ago talking with a farmer who was then preparing a load of tomatoes for market, and he remarked that it was at that time easier to sell a wagon load of tomatoes than when he first began to raise them to sell a peck. The reason why it is difficult to sell honey is that people generally have not learned to use it. Eight ounces per year for each person in the United States seems a very small quantity, but I presume that a large percentage even of that quantity is sold through the drug houses for medicinal purposes.

I have described what I believe is "the coming bee," and it seems to me that there is nothing impossible or unreasonable in the ideas advanced. If a proper amount of enterprise is shown, I see no reason why we should have to wait many years before the ideal is realized, because breeders are now beginning to understand the science of breeding and are giving up the old haphazard methods, and, therefore, progress is certain to be much more rapid than it has been in the past.—*American Apiculturist.*

THE total colored population, as returned under the census of 1890, is 7,638,360. Of this number, 7,470,040 are persons of African descent, 107,475 are Chinese, 2,039 are Japanese, and 58,806 are civilized Indians.

Correspondence.

The Deflections of a Tornado.

To the Editor of the Scientific American:

Some of your readers may recall an article by the writer in the SCIENTIFIC AMERICAN of August 15, 1891, in which was presented some peculiarities of a tornado that passed this region on May 20 of that year. It was characterized by a direct eastward route along a township line for a distance of thirty miles and deflections right and left within small limits to nearly every tall object near its path. After each struggle with a detached object offering much resistance, it was nearly always deflected.

On July 2, 1892, the township line, 6 miles south, was swept again almost due east for a distance of about ten miles by a storm in many respects similar. It manifested less force, but was only less fatal, perhaps, because fewer homes lay in its path. After its first descent its direction was to the northeast for perhaps a mile, but after destroying a house it proceeded the remainder of its route, at no time a dozen rods away from the midsection line, one-half mile north of the township line, swinging a little transversely toward bunches of trees, houses, etc. It seemed guided away from its first house by a line of wire fence (tearing up the posts). In fact, it seemed to get its first impetus due east by this. I recall that the former storm also followed directly up a long line of this fence till deflected by an obstruction. Much further on, some tall locust trees and an orchard seemed to deflect it from a low house which it missed only a few feet, but a tall house half a mile further on received the full force. After wrecking this it was again deflected northeast to some timber in a small "draw" half a mile further on. Down this it ran to a denser wood in a southeast direction, whence again it traveled eastward with the trees along a little stream. Coming into this a little further on was another timbered "draw," and a portion of the whirl split off and ran up this about sixty rods, although its direction was backward—a little west of north. Here this portion of the storm found itself in the center of a meadow. It went directly eastward again to a detached clump of trees, and was thence deflected southeasterly. The other portion of the storm had gone on directly east, but much less forcibly, emerging on to a lake. Now the portions began to approach each other, and passing one on either side of an ice house, they joined their fury on a tall wooden derrick. The roof of the water works engine room beneath was lifted and hurled northeast, but a low chimney was left unhurt. A frame house near by was moved only on its foundation. Again the storm split, the north portion spreading over a wide sweep and doing small damage; but the south branch was now still so furious as to utterly demolish a house one-fourth mile further on. From thence it too was scattered and for the next half mile only a wide path of broken trees marks the march of both, after which they lifted.

The signs of twisting were not marked, all debris being blown onward, but on all standing trees examined by the writer, the limbs on the south side are brought back west, carried around north and left streaming out eastward. This, I believe, is the reverse of the usual order north of the equator.

Now, since a string of fence posts and a narrow strip of timber seem capable, within certain limits, of guiding and deflecting these terrible clouds, may it not be just possible that, on our prairies, wind-breaks might be so planted, of some tall trees on either side of the buildings, as to guide these great forces around the homes or at least break them up into less destructive portions? Or might not a series of tall posts be similarly placed, or other tall objects erected for the same purpose? These two storms have certainly shown strong attraction for tall objects. May it not possibly prove something more than a theory that tall towers, like wooden derricks, might be so arranged as to guide tornadoes around towns and cities or other densely settled districts?

I should be glad if you could spare the space to invite brief statements of facts concerning the deflections of other storms, whether any such phenomena as I have noted have been observed to prevail generally. In heavily timbered regions there is small hope of anything practical being done, but there is just a hint that in level, open regions (and here the tornado is usually at its worst) we may yet contrive, when we know the laws of their progress better, to *conduct* these great forces as we do others. There is much to convince us that the great lambent cloud is highly electrified, and, like a silken wisp under the same conditions, it swings to objects near its path.

The smell of ozone in the atmosphere after the passage of this storm was very noticeable.

JAMES NEWTON BASKETT.

Mexico, Mo., July 5, 1892.

THE best form of bismuth to use in the treatment of infantile diarrhœas is the salicylate, it being the most actively antiseptic.—*Medical World.*

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RECENTLY PATENTED INVENTIONS.

Engineering.

STEAM CONDENSER.—Charles Grohman, Linoleumville, N. Y. The steam inlet of this condenser is in a raised middle portion of the top of a main case, transversely of which, within the casing, are arranged several series of cold water pipes, the cold water being made to travel back and forth several times through the pipes before it is discharged, while the steam is condensed by contact with the surface of the pipes, and is discharged in the form of water, through a central bottom outlet. The construction and arrangement of parts is such that the condenser is little likely to rust, and can be readily cleaned,

POWER TRANSMITTER.—Daniel McCarthy, Earle, Col. This is an improved device for transmitting the power of a piston rod to a belt, thus converting a reciprocating into a rotary motion. Upon the cross head on the onter end of the piston rod is arranged a frame, with a cylinder on each side, in which slides a plunger, operated by steam, coming through steam passages in the piston rod, thus providing a steam-actuated gripping mechanism, operated simultaneously with each stroke of the piston, whereby the belt is gripped at each forward and backward motion of the piston rod.

BOILER.—James R. Lutgen, Winlock, Washington. In this boiler is a sectional circular base pipe, above which pipes are concentrically arranged and connected with each other, upright pipes being set in the concentric pipes, and top concentric pipes being connected with the upright pipes, short vertical pipes connecting the base pipe with the first set of concentric pipes, the boiler also having various other novel features, designed to promote the quick and safe generation of steam without waste of fuel.

HARBOR.—Robert H. F. and Nicholas H. Sewall, Bessemer, Ala. This invention provides for forming a harbor by building walls after a certain plan, according to the location of the bar or other featnres, these being main wall portions and channel wings, the main wall portions being provided with flumes and with inwardly opening check valves, with various other novel features, whereby the ebb and flow of the tide, as well as the force of the waves, are utilized to establish, deepen, and maintain the channel and depth of the harbor or anchorage.

Railway Appliances.

RAILROAD RAIL FASTENING.—Henry A. Lyddon, Brainerd, Minn. This invention provides a means of fastening the rails to metal ties, the latter having near each end parallel lugs, pressed up out of the metal, and shaped to fit one side of the rail flange. A clamping plate binds the opposite flange, this plate having a spur entering a socket in the rail flange to prevent creeping, and being held in position by a locking key. The fastening is quickly made and very effective, and the rail may be shifted easily at any time on simply turning the key and removing the clamping plate.

SEMAPHORE SIGNAL.—Perry G. Stuart, Fitchburg, Mass. The semaphore arms are pivoted to a standard, at one side of which are vertically sliding rods, connected with the arms by links, the lower ends of the rods being pivoted to bell crank levers, to which is secured a cord or wire passing over a pulley, and directly connected with a swinging hand lever, which may be arranged in a signal house, at any distance from the semaphore. The construction is designed to be placed alongside of a railroad track, wherever a signal may be desired, the signal being positive in its operation, easily worked, of simple construction, and very cheaply made.

AXLE LUBRICATOR.—James S. Patten, Baltimore, Md. This invention provides a separate box for holding the lubricant, with a roller for conveying it to the car axle journal, the box being of reduced dimensions, to be held in the chamber of the box, which slides up and down in the hanger or pedestal as the springs of the car truck expand and contract. The box has a semicircular flange, which conforms to the axle, provided with ribs and a series of intervening grooves, which become gradually shallower as they extend outwardly to vanishing points, whereby they serve to reconvey into the box that portion of the lubricant scraped off the journal by the ribs.

Mechanical.

VARIABLE SAW MILL FEED.—Calvin Harbaugh, Pleasant Home, Ohio. The feed shaft is arranged parallel with the saw mandrel, and provided with a friction drum, there being friction disks driven by the mandrel, while a friction pulley, mounted on a movable shaft engages one of the friction disks and the friction drum, there being a lever mechanism for moving the shaft and the friction pulley on it. This feed is simple, cheap, and effective, and may be quickly and easily changed to drive the saw carriage at any desired rate and in either direction.

WOOD CUTTING TOOL.—Robert Roberts, No. 734 Leonard Street, Brooklyn, N. Y. This is a simple and inexpensive tool for general use as a routing implement for the gaining out of channels, either straight or curved, dovetailed or otherwise, and as an intaglio carving tool, the tool being especially designed for rapidly cutting out the zigzag channels in stair stringers, without the use of a boring tool or saw. There is a rest block on the upper edge of the shank, and a hub on its downwardly curved end opposite the handle, the hub being axially perforated to receive the stem of the cutter blade, which cuts with its side edges and free end.

HANGER.—James G. Duke, Memphis, Tenn. This is an improvement in hangers, especially adapted for supporting shafting, pipes, etc., providing a hanger of simple, durable, and inexpensive construction, for use in connection with an overhead or vertical support. There is also provided, in connection with the hanger a box, adjustable upon the hanger, both vertically and laterally, and the box may be employed no matter in what position the hanger may be placed, the box being also adapted for use without the hanger, when it may be secured to any support.

DRILLING MACHINE.—Otto Sternoff-Beyer, Carlstadt, N. J. This invention relates to multiple drilling machines for drilling a series of apertures in buttons and similar articles. A series of similarly revolving drills is arranged in a circle, but eccentric to the articles to be drilled, and a revoluble disk supports the articles opposite the drills.

PERFORATING MACHINE.—Charles O. Morgan, Morton, Minn. This is a light, durable, and inexpensive machine, which may be readily operated to perforate paper without tearing it, a cleaner being provided to prevent the paper, after being perforated, from rising upward with the punches. The machine is operated by a treadle, and is especially adapted for perforating paper for blank books, order books, etc., where sections are designed to be readily detached.

ANNEALING BOX.—Augustus Beyer, New Philadelphia, Ohio. This box is open at the bottom, and has the usual carrier or bottom plate, in connection with an auxiliary bottom plate having a series of transverse ribs resting on the upper side of the bottom plate, and forming air passages between the two bottoms or plates. The ribs on the auxiliary plate strengthen the bottom plate, so that it remains level and is not liable to crack, while they also form passages for the heat, saving time and fuel, and causing a more uniform heating, to prevent nneven coloring of the sheets.

OIL CAN.—Hans H. Thiellesen, Custer City, South Dakota. This can has an air chamber in its upper part, into which opens a hollow handle opening, an air compressor being connected with the handle, and a channel leading from the air chamber to the lower portion of the can. The construction is such that air pressure may be readily applied to the oil to force the latter from the discharge nozzle with considerable velocity, thus facilitating the ready application of oil to any part of machinery to be oiled.

Mining.

ORE CONCENTRATOR.—Gottlieb D. Husemann, St. Louis, Mo. Pivotally suspended from a frame is an upper box, to which is hinged a lower box, the boxes being reciprocated horizontally by a pitman, and being inclined in opposite directions. The boxes have solid bottoms, upon which are tubes or conduits perforated on their upper sides, and upon which are perforated sloping riffle plates, hoods, or covers, protecting the conduit openings, while a discharge pipe leads from the upper to the lower box, and from the latter to any suitable receptacle. The machine subjects the slime to the combined operations of washing, riffling, and concentrating, with very little mechanism.

Miscellaneous.

ELEVATOR.—Collins M. Stearns, Milwaukee, Wis. A shaft at each side of this elevator is fluted lengthwise to form long pinions, revolving in suitable bearings, these pinions engaging gear wheels on hubs which travel on screw rods, the hubs being attached to bottom and cross bars of the cage. The long pinions are rotated simultaneously, the cage traveling up and down according to the direction in which the pinions are revolved.

ALARM LOCK.—Frank Mahannah, Omaha, Neb. This is a simple and durable lock, more especially designed for use on cash drawers, and is arranged to automatically sound an alarm, either temporarily or continuously, whenever a wrong key is pressed in the lock. A series of vertical locking bolts is mounted on a stationary frame, and there are connections between the bolts not in the combination and the alarm, a sliding block on each bolt having reversely extending inclines, one to lower the bolt when it is active and the other to raise it when inactive or out of the combination.

TIME ALARM BED.—George Q. Seaman, Brooklyn, N. Y. This bed has a bottom hinged near its center, so that it may swing downward, this movable portion being supported on loose supplementary legs, and connection being made with a tripping disk, to be operated in connection with a time mechanism. At the time at which the alarm is set, the tripping mechanism operates to run the supplementary legs inward, so that the occupant is spilled upon the floor; or, in a doule bed, one occupant may be thrown out, if desired, without disturbing the other.

FOLDING UMBRELLA.—George H. Seymour, Stanton, Texas. A runner is held to slide on a folding stick, to the upper portion of which are pivoted ribs, each comprising a tabular outer section with longitudinal slot and solid inner section having a lug sliding in the slot, while braces are pivoted to the runner and to the lower or outer rib sections, the invention also including various other novel features. This umbrella may readily be made of a size to be conveniently inserted in a valise or satchel, and is designed to be rigidly held in open or closed position.

WIRE STRETCHER.—William D. Fulbright, Nichols, Mo. This is a device of simple and durable construction, designed more especially for use in building wire fences. It has two pivotally supported independent arms, having each a complementary lever, to grip the wire and exert tension on it, there being a locking device for the levers, and one arm with its lever serving, when locked, to maintain the wire under tension until gripped by the other arm and lever.

PUMP VALVE AND CASE.—John Neumann, Brooklyn, N. Y. In cases where it is desirable to locate the barrel of a pump in an ice receptacle, to cool the liquid drawn, this improvement provides means for the quick detachment of the valve case from the pump barrel, and its ready replacement in a secure manner. The valve casing has a flanged trough-shaped limb projecting into a chamber at the lower end of a pump barrel, a screw plug screwing into the limb.

CAN OPENER.—Smith Ehenger, Park City, Utah Ter. This is a combination tool, having a separable handle with an enlarged outer end formed into a scraper and adapted to exert a spring action on the handle members, one of the members being provided at one end with cutting blades, and a corkscrew being pivoted to one member of the handle. The device forms a simple and convenient tool, which may also be nsed for removing the wires from bottle necks and stoppers.

BOTTLE FILLING APPARATUS.—Michael J. McHugh, Jersey City, N. J. This is a device which can be quickly applied to any bottle-filling machine, and automatically carries the cork-retaining bail from an unlocked to a locked position over the cork at the proper time. A cross head, carrying the cork tube, has a vertical bolt aperture, through which extends a bolt on the cross bar of the bail seater, levers depending from the ends of the bar having feet at their lower ends, while a spring throws the ends toward each other.

LANTERN.—Daniel W. Cronin, Little Rock, Ark. This is an improved hand lantern, with a glass globe to protect the flame, and is provided with a central draught and return flues, to increase the efficiency of the lamp by enlarging its illuminating power and by rendering the combustion of the illuminant more perfect. The invention covers a novel construction and combination of parts.

FIRE ESCAPE.—Carl F. Ekman, Marshalltown, Iowa. A ladder that can be quickly and easily extended at any angle is provided by this invention, and a hose may be connected to the ladder to make a water tower of it, while hoisting devices may also be attached to it, whereby a number of people may be rescued at one time. The ladder is made with lazy tongs of novel construction, its links being continued beyond the outer joints, and the whole device is supported upon a wagon body or truck, upon which the ladder frame turns horizontally, means being provided for the balancing of the ladder trnck.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

SCIENTIFIC AMERICAN BUILDING EDITION.

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1. Elegant plate in colors of a colonial residence, at Belle Haven Park, Greenwich, Conn. Perspective view, floor plans, etc. Messrs. Lamb & Rich, architects, New York. Cost $18,000 complete.
2. Plate in colors of an attractive colonial house on Clairmont Avenue, Montclair, N. J. Floor plans and perspective elevation. Cost $7,000 complete. E. T. Hapgood architect, New York. An excellent design.
3. A suburban cottage at Rutherford, N. J. Cost $2,000 complete. Floor plans and perspective elevation. Mr. C. D. Jones, New York, architect.
4. A residence near Newark, N. J., erected at a cost of $7,000 complete. Floor plans and perspective. Munn & Co. architects, New York.
5. Engraving showing the North M. E. Church, at Chester Hill, N. Y. Cost $5,250 complete. Mr. Charles E. Miller, architect, New York.
6. A carriage house and stable erected at Portland, Me. Cost $700 complete.
7. A summer cottage at Great Diamond Island, near Portland, Me. Cost $3,200 complete. Messrs. J. R. & W. P. Richards, architects, Boston, Mass.
8. A residence at Rutherford, N. J., recently erected at a cost of $4,500. Perspective and floor plans.
9. A cottage at Oakwood, Staten Island. Estimated cost, $3,300. Plans and perspective elevation.
10. A row of model dwelling houses on West Seventy-fifth Street, New York City. Mr. James T. Hall, architect, New York.
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(4472) B. G.—For the information you desire concerning musical intervals we refer you to "The Theory of Sound in Relation to Music," by Professor Blaserna, price by mail $1.50.

(4473) F. P. D. asks how to remove printer's ink from cardboard. A. Apply sulphuric ether with cotton wool, rubbing gently. Continne the application of fresh ether until the stain disappears. Sulphuric ether is very inflammable; so do not try to remove the stain at night.

(4474) R. N. C.—Antichlor is composed of sodium sulphite. So called because it is used in paper making to remove the last traces of chlorine from the paper pulp.

(4475) H. H. J.—The St. Chamond Works in France is said to have the largest tempering bath in the world, being 72 feet deep and containing 44,000 gallons of oil, which is kept in motion by rotary pumps.

(4476) M. G. S.—Catgut is the name applied to strings, made chiefly from the intestines of sheep, used for harp, violin, guitar, and bow strings, hatter's strings, etc.

(4477) J. L. T. says: In your reply to C. E. B., query No. 4419, date of June 25, you give the horse power of 7 inch artesian well with one inch nozzle and a 3 foot Pelton wheel as 17, to run a 150 bbl. mill. Below I give you the measurement of two wells; will you kindly give the horse power with different nozzles using a 6 foot Pelton wheel? No. 1. 8 inch well, closed pressure 60 pounds, full flow 440 cubic feet per minute; 6 inch opening, 13 pounds pressure, flow 390 cubic feet per minute; 4 inch opening, 30 pounds pressure, flow 272 cubic feet per minute; 2 inch opening, 50 pounds pressure, flow 92 cubic feet per minute. With 70 pounds pressure and the same flow, what would be the increased power? Well No. 2. 8 inch well, 67 pounds closed pressure, full flow 162 cubic feet per minute; 4½ inch opening, 30 pounds pressure; 2 inch opening,

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60 pounds pressure; 1⅛ inch opening, 65 pounds pressure. The above I believe are two extremes as to flow, and both wells are for power purposes. In well No. 1 the pressure has increased to 70 pounds since the above measurement was taken, while the flow of water has decreased. A. The power obtainable from well No. 1, is for the 6 inch opening 18 horse power, for the 4 inch opening 30 horse power, and for the 2 inch opening 16 horse power. Notice that the 4 inch opening gives the largest available power and is equal to a constant head of 69 feet. It should run a 6 foot Pelton wheel 96 revolutions per minute. The power is directly as the pressure, and at 70 pounds as stated is 16 per cent more than the power above stated for each pressure and volume of flow. The well No. 2 is evidently constricted in the inlet, as the full pressure is greater than well No. 1, but the open flow is only about 37 per cent as much. As you give no volume of flow under the different pressures, we have to assume a condition of flow, which makes the 2 inch opening the largest available power. For the 4½ inch opening, 12 horse power; for the 2 inch opening, 24 horse power; and for the 1½ inch opening, 16 horse power. Your statement that well No. 1 has increased its pressure and decreased its open flow since the measurement indicates an obstruction to the inflow at the bottom.

(4478) W. J. A. writes: I want to construct a resistance box for the 8 light dynamo and would like to get some instructions. I want it placed on top of the field magnets and be as small as possible. What is the least size wire that I can use? A. You can use for your rheostat No. 24 iron wire. It is immaterial about its maximum resistance. You can put in say from 50 to 75 feet of wire in small coils, and arrange the switch so as to cut the coils out gradually. 2. If I place the resistance between the fields, must I use 50 ohms for every lamp not in use? A. The resistance substituted for the lamp must be the same as that of the lamp when it is introduced into the lamp circuit; but less is required when the machine is shunt-wound and the resistance is placed in the field magnet circuit. 3. Would placing the dynamo on a cast iron base affect the machine in any way? If it does, how can it be remedied? A. The dynamo should not be placed on a cast iron base, better use a base of wood. 4. In my machine, I have one wire from the armature connected with the end of the wire from the field magnet and passing to the lamps, the same way for the other wire from the armature. Is the machine properly connected? A. Your connections are correct for a shunt machine.

(4479) E. R. asks: 1. Would the working of a Samson battery be affected if the zinc be a solid cylinder instead of having a slit down one side? A. The slot allows the fluid to circulate in the battery. 2. Could electricity be generated as follows: Place the bottom of a tin can in front of a bar magnet, which is within a helix, and after being properly adjusted, allow sound waves to beat upon the diaphragm or bottom of the can (most of the tin cans being nothing but sheet iron coated over with tin). A. Yes. 3. What sized wire gives the best results in the telephone? A. The finest wire, No. 36, is commonly used. 4. Could the diaphragm of a telephone be manipulated by mechanical means in such a manner that it would give forth sound at the other end of the line? Or, in other words, could a dumb man manipulate the diaphragm in the manner described so as to talk to his friends by sound? A. We think a code might be adapted to the use mentioned. 5. If the electricity is made by the vibration of the diaphragm in front of a magnet, why are batteries used on telephone lines? A. Batteries are used in connection with a transmitter, as it is found that a better result can be secured by means of a transmitter and an induction coil for sending speech than can be secured by the simple Bell telephone.

(4480) A. W. S. says: Will you please inform me through your Notes and Queries column as to whether the dates of the summer and winter solstices are fixed or movable? Also, if fixed, whether the longest day is the 20th, 21st, or 22d of June? And if movable, by what rule can the longest day in any given year (*e. g.* 1853, 1877, or 1892) be determined? A. The solstice is not fixed, owing to the fractional day required to complete the year, so that every four years the solstices recur with a slight variation due to the centennial leap year and the precession of the equinoxes. This year the 20th of June was the longest day. The summer solstice is exactly 91·3125 days from the hour of the vernal equinox, which can be obtained from the Nautical Almanac. Its computation may be derived by adding the tropical years to a fixed epoch. See Nautical Almanac, published in Washington.

(4481) J. B. writes: Please explain the action of a current of electricity passing along a wire a considerable distance (say 100 feet or so) then turning short about and returning to place of beginning, the outgoing portion of the loop and the returning portion being insulated and lying close together the entire route, and the two single ends attached in circuit, so as to cause the current to pass around the loop. A. In the case mentioned there would be no action, as the wires would mutually react upon each other, and the effect would be nothing.

(4482) J. C. H. asks: 1. How many storage cells can the eight-light dynamo charge at one time? A. 30. 2. How often should the solution of a storage cell be renewed? A. It does not require renewal. 3. Does the Daniell cell give a greater current than the gravity? Has it more resistance than the gravity? A. The Daniell and gravity cells are about alike. It depends on the construction of the battery. 4. In applying one pole of a battery to the binding post and the other pole to the field magnet of a motor, it gives a spark. Is that the sign of a leak in the magnet conductor? A. Yes.

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Milling is the title of a new illustrated monthly magazine of about the size of Scribner's and Harper's monthlies, published by the D. H. Ranck Publishing Company, Indianapolis, Ind. It is not solely devoted to milling or the state of the crops, and statistics of the products of the different cereals as its title might imply, but it contains illustrations of engineering works of magnitude now under construction in the West and well written articles on scientific and general mechanical subjects.

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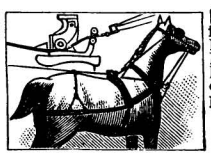

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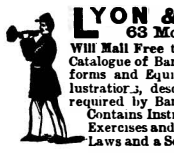

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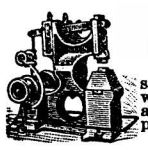

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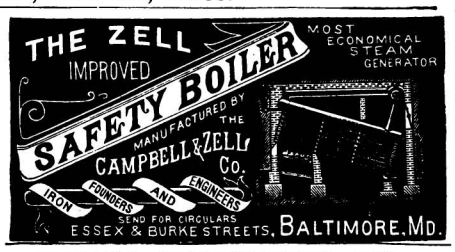

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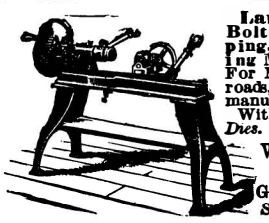

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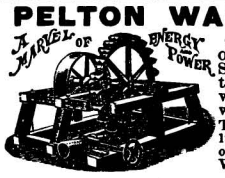

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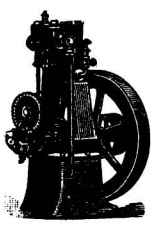

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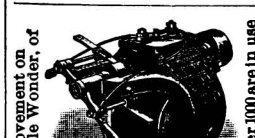

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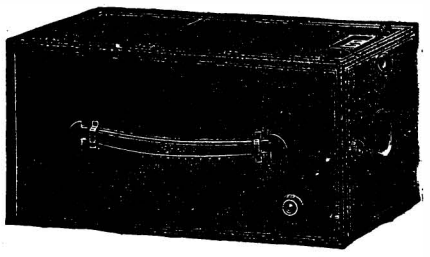

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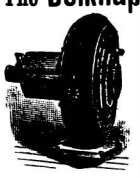

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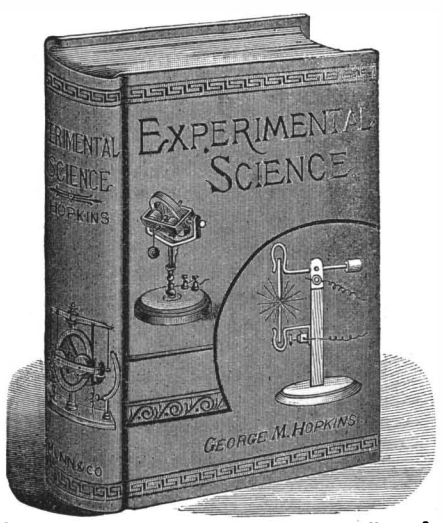

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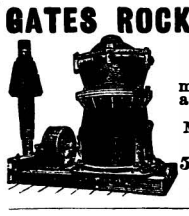

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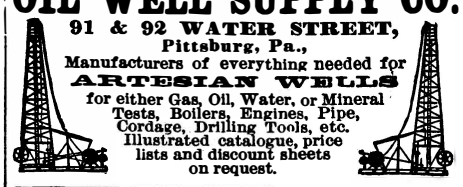

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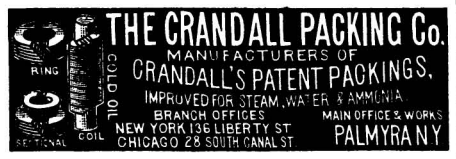

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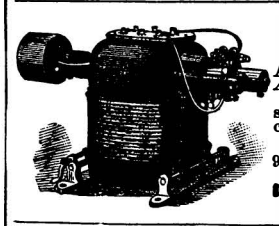

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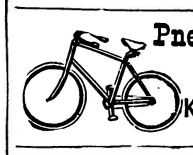

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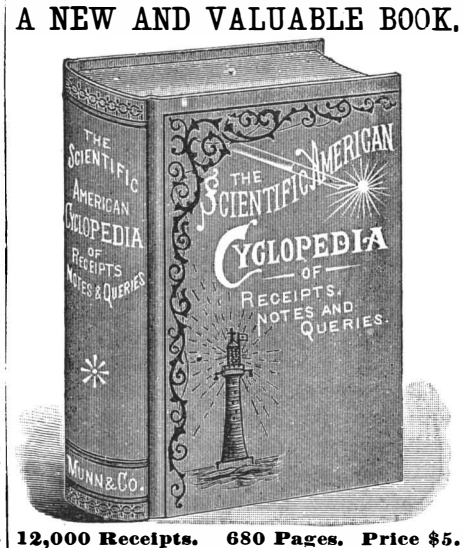

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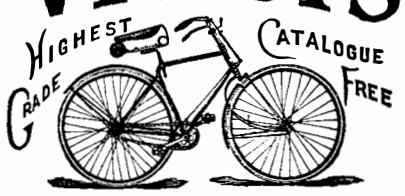

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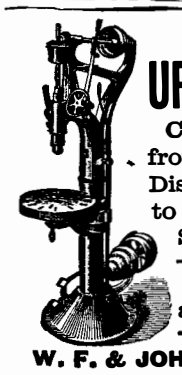

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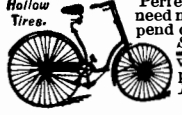

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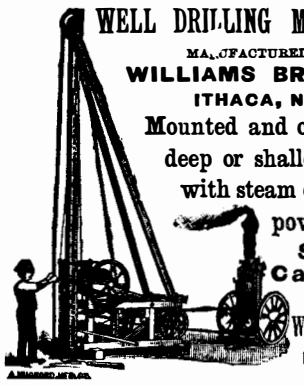

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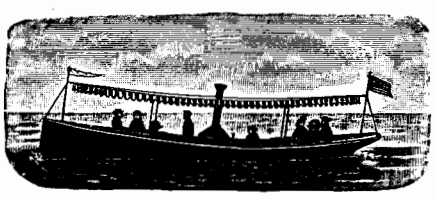

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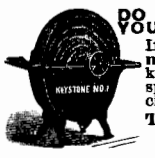

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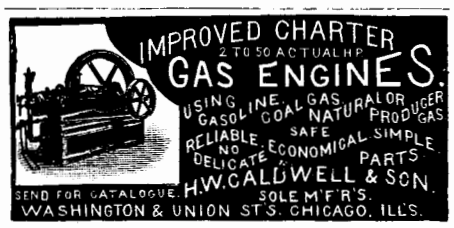
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